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AERIAL AGE WEEKLY

VOL. 13, No. 21 AUGUST 1, 1921 10 CENTS A COPY

A Remarkable Airscape of Entire Manhattan Island. Photographed for the Fairchild Aerial Camera Corp. by W. L. Hamilton

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The Navy's Urgent Need

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

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AUGUST 1, 1921 AERIAL AGE VOL. XIII, No. 21

TABLE OF CONTENTS

A Consolidation 483
The News of the Week 484
The Aircraft Trade Review 486
The Bristol Commercial Ten-Seater Biplane 487
The Spad "Berline" S-33 488
The Pueblo Flood Relief Expedition 489
Aeroplane Flight Endurance 490
Aero Club of Pennsylvania 492
Naval and Military Aeronautics 497
Foreign News 498
Elementary Aeronautics and Model Notes 499
Aeronitis 501

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Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

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THE NATIONAL
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With which is consolidated

Flying

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A Consolidation

WITH this issue, FLYING, the monthly aeronautical journal which was established in 1912, is consolidated with AERIAL AGE WEEKLY. AERIAL AGE, from the standpoint of prestige and circulation, has been the leader in American aeronautic journalism, and by the accession of the large body of *Flying* readers throughout the entire world, it now assumes a unique role in relation to the world aeronautics. It now has by far the largest circulation of any aeronautic publication published in the English language, and it will wield now an even greater influence for the advancement of aerial transportation and for the broadening of the American aeronautic industry.

Through a number of causes, aeronautic development and application is moving all too slowly in America, but there are now clearly defined evidences of constructive progress. AERIAL AGE stands squarely behind all movements for the advancement of aeronautics, and offers every encouragement and cooperation to plans that will develop business for the American industry.

The Navy's Urgent Need

A NAVAL bill that provided $90,000,000 for new capital ships and nothing for fast aeroplane carriers was a blunder before army aviators sank the German dreadnought Ostfriesland with 2,000-pound bombs. Who will now defend the action of the House in striking from the Senate bill the appropriation for two carriers? At the present time the navy possesses but one carrier, the Langley, formerly the collier Jupiter; it is the joke of the service, because its maximum speed is only twelve knots. As Congress made an appropriation for this ark of an aviation ship that everybody knew would be obsolete as soon as she was fitted up to carry planes, ignorance of the sore need of the navy could not be pleaded when the Senate proposal was rejected.

Great Britain, whose fleet includes seven aeroplane carriers with a speed of from 25 to 31 knots, is, in good-will at least, as much our ally today as she was during the conflict with the Central Powers. War with Great Britain is inconceivable, say eminent publicists, and it is the general view. But if Great Britain were disposed for any reason to compete with the United States in naval armaments, she would be gratified to observe Congress neglecting aviation while continuing to build capital ships that could be sent to the bottom by bombs dropped from the air. If war with Great Britain is inconceivable, hostilities with Japan might be precipitated by the failure of diplomacy to settle questions in controversy relating to Yap, Shantung or land laws. Japan is now building a carrier of battle-cruiser speed that will accommodate thirty aeroplanes. It is to be the first of a squadron and will be completed next year. A ship of this kind takes almost as long to build as a battleship. Great Britain's swiftest carrier, the Furious, has a length of 735 feet and her displacement is 19,100 tons. She was laid down as a capital ship and converted. If Congress voted appropriations for two carriers tomorrow, they would not be completed before the end of 1922, or later.

Before it was known in Washington that the aviators could destroy a capital ship there were intelligent students of naval warfare who urged the addition to our fleet of aeroplane carriers. On May 5 Representative Britten of Illinois introduced a bill for the construction of two such ships. "The war," he said, "has taught us that without adequate aviation support at sea our navy would be helpless before an enemy controlling the air." Secretary Denby went before the House Naval Committee a week later and begged for one carrier. The committee gave its approval to a bill providing for such a vessel, but the short-sighted economists on the floor of the House were satisfied with the absurd Langley. At the same time they were ready to vote $90,000,000 for construction work upon the capital ship program of 1916. It should now be understood that the powerful Pennsylvania and the more formidable Maryland would be vulnerable to bombing attack, although a larger explosive than finished the Ostfriesland might be required to demolish them. If it is true, as General Williams said, that the bomb that sank the German dreadnought was heard round the world, may it not be hoped that ears in the House of Representatives were not impervious to the explosion?—*Editorial in New York Times.*

THE NEWS OF THE WEEK

Pulitzer Race Plans Cancelled

The Pulitzer Race, which was scheduled to be held in Detroit under the auspices of the Detroit Aviation Society, in September, has been cancelled. In a letter to the officers and directors of the Society, Colonel Sidney D. Waldon, gives the reasons for this action as follows:

In the firm belief that we had the full cooperation and support of the Army and Navy in the running of a big aerial race meet this Fall, the Detroit Aviation Society, Inc., was organized, and a great deal of good work done by its officers, directors, committee chairmen and members. There was never any question but that the races were desired by both Air Services as a very valuable means of stimulating engineering and making comparative tests under strenuous conditions of the best types of both Army and Navy equipment.

The first inkling of doubt about Government entries came about June 11th, in the form of a rumor that the Secretary of War had ordered the Army not to participate. It was not, however, until practically June 20th that we had definite advice from the Army Air Service that their participation had been denied by the Secretary of War, but stating that the same request for authority might be resubmitted July 1st, after the Army Appropriation bill had been passed.

A day or two later we received a very encouraging letter from the Navy Department, under date of June 25th, signed by Captain Moffett, indicating that the Navy was considering the entry of nine (9) machines.

On Friday, July 1st, Harold H. Emmons, counsel for the Detroit Aviation Society, Inc., called on representatives of the Army and Navy but could obtain no definite committal from either department. The impression he gained was that the matter would not be definitely decided for another ten days.

On July 14th, Harold H. Emmons and the writer had interviews with the Air Services of both Army and Navy, as well as interviews with the Secretaries of War and Navy. It was apparent on this date that while the Air Service officers themselves were keen for the holding of the air meet, that the Secretaries were inclined to deny the authority and funds.

At the close of our interview with Secretary Weeks late in the afternoon of July 14th, he agreed to call Major General Menoher into conference the first thing Friday morning; that he would also take up the matter with the Secretary of the Navy, before or after a Cabinet meeting at noon, and that he would give us the answer for both at 5:00 o'clock Friday afternoon.

The writer saw Secretary Weeks Friday evening, and received his decision that in view of the urgent necessity for economies in all branches of the Government—(and particularly in view of the shortage of certain appropriations affecting the Army Air Service)—that neither the Army nor the Navy would participate in these races this year. The Secretary of War agreed to write a confirming letter, which however has not as yet been received.

We endeavored to make clear to both Secretaries the obligation that we owed to every worker and contributor to this project—that we were undertaking it for the advancement of the science of aviation and in no wise for personal gain—and that both the Army and Navy and ourselves owed quite an obligation to these same workers and contributors to hold the event as early next year as would be most satisfactory to the Army and Navy.

It is with very deep regret that I am writing this letter to acquaint our whole organization that our air meet must be postponed to next summer.

Harding For Uniting All Aircraft Services

Washington—President Harding favors the proposal to place all the aircraft services of the Government, miltary and civil, under one central authority, according to a correspondent of the New York Times.

There has been an impression that the President was opposed to this plan, especially when Major Gen. Menoher, Chief of the Air Service of the army, asked the Secretary of War to remove the Assistant Chief, Brig. Gen. William Mitchell, who was a persistent advocate of amalgamation of the army and navy air services. It was learned, however, that the President is heartily in favor of the proposed amalgamation and that the Joint Reorganization Commission, which is engaged in preparing plans for a reorganization of the executive branch of the Government, is inclined to recommend the unification of all the Government's aircraft activities.

The position of President Harding is that amalgamation will work for efficiency and economy. One great difficulty of the present separate aircraft services that has impressed him is that there is no systematic method of awarding contracts for the construction of aircraft. One branch makes contracts without regard to any other Government aircraft organization, and the President believes that this is detrimental to the upbuilding of private aircraft manufacture in the United States.

The aircraft manufacturers are dependent almost entirely on Government patronage, as commercial demands are very small, and it is claimed that unless the Government so arranges its contracts as to distribute them among all those concerns which produce aircraft meeting Government standards some of them may be obliged to go out of business.

The inference is also drawn from what was learned of the President's position that he is in favor of the amalgamation of the War and Navy Departments into a Department of National Defense. The plan under consideration by the Reorganization Commission contemplates having a Cabinet officer at the head of this department with Assistant Secretaries under him, in charge of the army, the navy and the aircraft service.

James Wins London Derby

J. H. James won the aerial Derby of 200 miles July 17, consisting of two one-hundred-mile circuits around London. No Americans were among the twelve starters.

The race started at Hendon, with turning points at Brooklands, Epsom, West Thurrock, Epping and Hertford. James, who is considered the best flyer since the death of Harry Hawker, was the winner of two trophies, both for the fastest time and handicap with $3,000 in cash presented by the Royal Aero Club. James covered the 200-mile course in 1 hour and 14 minutes or at an average speed of 163.34 miles per hour.

As a preliminary to the Derby an inter-university air race took place between teams representing Cambridge and Oxford. The course was three times around a forty-mile circuit touching Hendon, Epping and Hertford. The race was won by Cambridge on points.

National Airways Centre in New York

New York city and New York State, both for military preparedness and for commercial enterprise, are counted upon by the War Department to take a progressive, leading and important part in the development of great national airways. Mineola is decided upon by the War Department for one of the group aerodromes, with strategic locations along the Atlantic coast.

The War Department has drafted tentative plans for eight great airways, three of which are transcontinental, as part of the programme for developing the air service. These airways are to be developed through the National Guard, constituting one-third of the reorganized arms, and the organized reserve, constituting one-half of the reorganized army.

One of the transcontinental routes starts from New York, hitting the principal southern great lakes ports as it proceeds westward to Seattle, and connecting at Chicago with another transcontinental airline to San Francisco. By a short flight from New York to Washington connection is made with the Eastern terminus of the mid-continent route from Washington to San Francisco. New York also is on the Atlantic coast airway from Portland, Me., to Key West.

Many places in New York State have been selected by the officials of the Air Service as headquarters for units of the National Guard and organized reserve, these citizen soldiers to be in charge of the local aerodromes, municipal landing fields and radio signal stations. The proposed distribution of these air service units in the Second Corps Area, including New York, is as follows:

Albany—One division air service, one corps air service headquarters, one air park, one communication section, two aerodrome companies, one pursuit squadron—all of these units being of the organized reserve.

Atlantic City—One division air service (National Guard) and one balloon company (organized reserve).

Binghamton—Where a municipal aerodrome is already available, one observation squadron of the organized reserve.

Buffalo—One group headquarters, one balloon company, one balloon park, one communication section, two attack squadrons, one air park, one group headquarters and two observation squadrons—all of these units being in the organized reserve.

Ithaca—One observation squadron and one photo section, both of the organized reserve.

Mitchel Field—One observation squadron and one photo section, both of the regular army.

Newark—One balloon company and one communication section, both of the organized reserve.

New York City—One division air service (National Guard) and the following units, all of the organized reserve: One corps air service headquarters, two observation squadrons, one air park, one photo section, one communication section, one army air service headquarters, one headquarters squadron, one aerodrome company, two group headquarters, two pursuit squadrons, two attack squadrons, one air park, one photo section, one general air service headquarters, one headquarters squadron, one airship company, one aerodrome company.

Plattsburg—One division air service and one balloon company, both of the organized reserve.

Poughkeepsie—One observation squadron of the organized reserve.

Rochester—One division air service, two photo sections, one group headquarters, one balloon park, one communication section, one pursuit squadron, two photo sections, one balloon company and one balloon park, all these units being of the organized reserve.

Schenectady—One pursuit squadron of the organized reserve.

Syracuse—Two pursuit squadrons and one air park, both units being of the organized reserve.

Trenton—One balloon company, one group headquarters and one photo section, all three being of the organized reserve.

Troy—One pursuit squadron, organized reserve.

Wilmington, Del.—One balloon company, organized reserve.

Big Reunion of Air Men

For the first time since the war, men who served in the air forces are to have a reunion, at the International Air Congress, in Omaha, Nebraska, November 3, 4 and 5, the three days immediately following the American Legion Convention at Kansas City, just a short distance from Omaha.

At the reunion to which every one interested in the promotion of aviation and the maintenance of America's supremacy is invited, a national air organization will be formed with those ideas in view. At the present time, state bodies are being organized in each state to send delegates to the national meeting.

All American Aces will be invited to come, as well as prominent men in the air game, and other notables, including President Harding, Marshal Foch, Sir Douglas Haig and others.

Governor S. R. McKelvie, Secretary of State Darius Amsberry, Mayor James S. Dahlman and Commissioner Dan Butler signed the invitations to President Harding, Marshal Foch and others.

The invitations were sent to the state capitol by aeroplane, the ship belonging to the Aero Club of Omaha, Inc., which is promoting the big congress. The invitations were signed by state officials and then rushed back to Omaha by air and sent to Washington by air mail within a few hours.

At the Congress a complete exhibit of all types of aircraft manufactured will be shown in three big circus tents near the flying fields. Air equipment, guns, bombs, airial cameras, parachutes, and everything pertaining to airial development will be on display. Manufacturers are already making reservations.

Over $10,000.00 in cash prizes are to be offered in the air meet, which will be held in connection with the exhibit and reunion. Events will consist of derbies, sprints, climbs, feature races and events for balloons and flying boats. A big prize will be offered for a record in the altitude contest.

Other features of the Congress will include an aerial pageant, depicting the bombing of a French Village and a battle in the clouds for which the assistance of the General Electric Company has been obtained.

Among the men who will come to Omaha for the Aero Congress will be hundreds of men who served in Europe. Group unions will be held for the men who served in the various squadrons, escadrilles and training schools.

The Aero Congress promises to be a great big event and every man interested in aviation is urged to attend.

N. E. A. by Aeroplane Aid Beat All Competitors

Jack Dempsey knocked out Georges Carpentier at 3:31 Saturday afternoon, July 2, in the great arena at Jersey City.

And at 12:16 Monday afternoon, about 48¾ hours later, the Newspaper Enterprise Association, by means of special airplanes, a special train and the United States airmail service, delivered pictures of the knockout in San Francisco.

Four N. E. A. camera men, under Bob Dorman, chief N. E. A. photgrapher, snapped shutters while the referee was counting the toll over the prostrate body of Carpentier. Four couriers carried the plate holders to four waiting motor cyclists outside the arena. These machines rushed the plates to the aeroplane landing field a mile away, where they were packed in wooden boxes and hurried aboard three Curtiss Oriole planes, one piloted by R. H. Depew, Jr., manager of the Curtiss Flying Field at Garden City, Long Island, another by John M. Miller and a third by Wesley L. Smith, a United States airmail pilot. Miller was to carry his plates to Bellefonte, Pa., where they were to be transferred to another Curtiss Oriole piloted by E. M. Ronne, manager of the Curtiss field at Buffalo.

The three machines took off with a rush at 3:50 p. m., bound for Cleveland. They stopped a few minutes to re-gas at Bellefonte, Pa., and then roared down the home stretch to Cleveland, where they arrived at 8:30. One hour later the Cleveland Press was on the street with a picture of the knockout in a special edition. It was the first paper in Ohio or the west to turn the trick.

Waiting automobiles sped like the wind to the main plant of the N. E. A. in Cleveland, where the plates were developed.

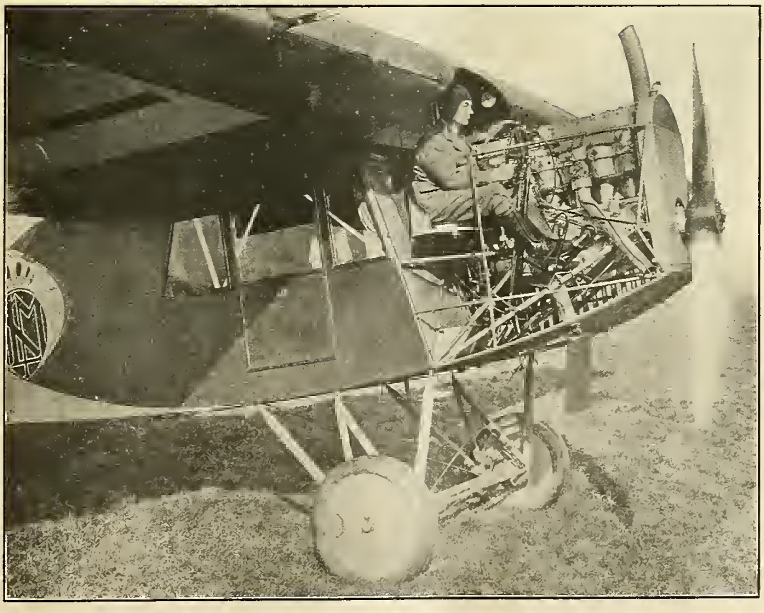
L. Van Oeyen, Clarence Stieglitz, N. E. A. photographer who flew in one of the planes from Jersey City to Cleveland, and several assistants hurried aboard a special train chartered by the N. E. A. To this train was attached a baggage car which had been transformed into a photographic studio complete in every detail. While the special was rushing from Cleveland to Chicago, always at a rate of more than 60 miles an hour, prints were made for the N. E. A. clients throughout the west.

The special train glided into the La Salle Street station at 4:50 Sunday morning, where R. J. Gibbons Chicago representative of the Newspaper Enterprise Association, had in waiting taxicabs which carried prints to the United States airmail field to a special plane chartered by the Newspaper Enterprise Association and piloted by Ralph C. Diggins, and to the first trains leaving in all directions.

The United States mail plane hopped off at 8:30 a. m. After a rapid flight the plane transferred its packages of pictures to a mail train at North Platte, Neb., at 3 o'clock Sunday afternoon. Without a moment's delay the pictures were whirled onward to Rock Springs, Wyo., where a United States mail plane was in waiting to rush them to the Pacific coast. The transfer at Rock Springs was made in record time and the U. S. plane started its flight for San Francisco, more than 800 miles away. The necessary stops to replenish the gas and oil tanks were made, but aside from that the plane continued its steady distance-eating flight without incident.

At 12:16 Monday afternoon it landed at the United States airmail field in San Francisco where the prints were conveyed to the plant of the San Francisco *Daily News*.

The flights made by the United States airplane and the N. E. A. special plane piloted by Coffee from Laramie to San Francisco are regarded as two of the best air performances ever made in the west.



The latest type of Fokker Commercial Limousine, with A. A. G. Fokker, the designer, at the wheel

The AIRCRAFT TRADE REVIEW

Fokker to Build American Planes

Coincident with the arrival at Hazelhurst Field, L. I., July 21, of the Fokker limousine, five-passenger monoplane, comes the announcement that the Netherlands Aircraft Manufacturing Company of Amsterdam and New York will shortly commence the manufacturing of Fokker machines of all types in this country. The limousine, which is known as the Fokker F-III, will be thoroughly demonstrated this afternoon by Bert Acosta, probably the best known civilian pilot in this country, who has become test pilot for the Dutch company. Anthony H. G. Fokker, whose machines are now carrying passengers on every airway in Europe, said when he visited this country recently that he regarded the United States as the most fertile field for aircraft exploitation, and signified his intention of invading the American field as soon as his European contracts would allow. The limousine is the first of the ships he has sent here to make good his promise.

R. B. C. Noorduyn, who with F. Cremer is taking care of the Netherlands interests here, said yesterday that the limousine is the highest development of the passenger-carrying aeroplane now in use in Europe.

"Its design emphasizes the fact that war machines are not adaptable to commercial use," he said, "and Mr. Fokker was one of the first to understand this. The war machine, of which there are thousands in Europe, is too expensive and too dangerous to operate commercially. The war machines were about as useful for commercial air transportation as a battleship would be when converted into a trans-Atlantic liner.

"Realizing that the operating costs must be reduced to a minimum and the useful load increased as much as possible, Mr. Fokker as soon as the war ended set to work to design successful commercial aeroplanes. The limousine now at Hazelhurst Field is the last development in the way of a passenger-carrying ship. It will carry, in addition to the pilot and fuel sufficient for more than 500 miles' flight, five passengers and their luggage or, instead, more than 1,000 pounds of freight. With a motor of only 220-h.p. and a fuel consumption of about twelve gallons of gasoline an hour this machine will maintain an average speed of 105 miles per hour. The cabin is very roomy and contains seats for five passengers, two of which are easy chairs. It is beautifully upholstered on the sides and ceiling, and the floor is heavily carpeted. There are three windows on each side, two of which may be opened with ease, and the temperature of the cabin is regulated so as to be always comfortable, no matter how hot or cold it may be outside.

"The fact that the limousine is a monoplane, with the wing high above the carriage, allows the passengers an uninterrupted view when in flight. The wing, which is more than two feet thick, is built on the cantilever principle and needs no struts or guys to support the carriage. This limousine is the most advanced type of passenger carrying aeroplane, and its record performances are attested by the thousands of passengers who are being carried successfully each week abroad."

Arrangements have been made by the officials of the Netherlands Company for a series of flights out of New York. One of the first of these will be a non-stop trip to Washington, where the machine will be demonstrated for the benefit of Government officials. It is expected that the manufacture of Fokker machines by American mechanics from materials obtained in this country, will commence early this Fall.

Davis-Douglas Company Reorganized

The Davis-Douglas Company of Los Angeles, Cal., has been reorganized and is now engaged exclusively on government contract work.

The officers of the company are as follows: Donald W. Douglas, Pres.; Wm. M. Henry, Vice-Pres. and Sec.; H. C. Rich, Treas.

Tri-City Aerial Transportation Company

The R. H. Bloxham Aviation Company of Chicago has been consolidated with the Tri-City Aerial Transportation Company of Rock Island, Ill. In addition to exhibition work the company is conducting a school of instruction.

The officers of the company are H. L. Brandenburg, Pres.; J. J. Gruske, Secy.-Treas., and R. H. Bloxham, Gen. Mgr. and Chief Pilot.

Field at Cleveland, Tenn.

A landing field has been established at Cleveland, Tenn., and is named Emmett Flying Field. It is situated a half mile west from the center of the city. It has a standard marker and cross-country aviators are invited to use the field.

Aerial Newspaper Delivery

The Oregon, Washington & Idaho Airplane Company of Portland, Oregon, western distributors for the Curtiss Aeroplane & Motor Corporation, report an interesting commercial venture in the delivery of newspapers.

Last year from mid-June until September, on seventy-five consecutive week days, copies of the Oregon Journal were delivered to Seaside and Astoria from Portland by flying boat, a distance of 120 miles. By this method the Journal beat all other papers by hours and is consequently very popular with the large summer colony at these beaches.

Because of the success of this delivery during 1920, the service is being repeated this year, the first papers being carried on July 3rd with complete details of the Carpentier-Dempsey fight.

It is the boast of the company operating the line that the papers will be delivered in spite of weather and to date they have supported this boast by a 100% service.

New French Altitude Record

Paris.—Lieutenant Kirsch, the French aviator who was a contestant last year in the James Gordon Bennett Cup race at Etampes, is declared to have reached an altitude of 10,600 meters (about 34,768 feet) July 15 in an attempt to break the world's altitude record. Although the official world's altitude record made by Capt. R. W. Schroeder, of the United States Army, at Dayton, Ohio, on February 27, 1920, is only 33,000 feet, it is thought improbable that the Aero Club of France will certify Lieutenant Kirsch's record.

Lieutenant Kirsch started his flight at Le Bourget aviation field, near Paris, and landed at Champaubert, Department of the Marne, more than one hundred miles northeast of Paris, when engine trouble compelled him to descend.

During his flight the aviator noted a temperature of 69 degrees below zero, while thermometers in Paris registered 97 degrees above.

Seaplane Landing at Yorktown

Seaplanes landing at the flying field at Yorktown, Pa., are advised that shoal water extends 300 yards off the southern bank of the York River abreast the field. Landings should be made well offshore and planes taxied to the beach by way of the channel extending into the mouth of Felgates Creek. A line of stakes has been placed to mark the eastern edge of this channel. Planes should be beached as close as possible to the dock at the mouth of Felgates Creek, as the shoal referred to uncovers at low water.

Gasoline, oil, and facilities for minor repairs are available. Large planes anchoring off the beach can obtain a motor dory by signaling to the dock.

Personal Par

Frederick Trubee Davison, eldest son of Henry P. Davison of the firm of J. P. Morgan & Co., has been endorsed for the Republican nomination for Assemblyman from Nassau County by the Republican Town Committee of Oyster Bay.

D. J. Spence, Jr., was the first member of the Aero Club of Pennsylvania to win the club badge given for bringing in new members.

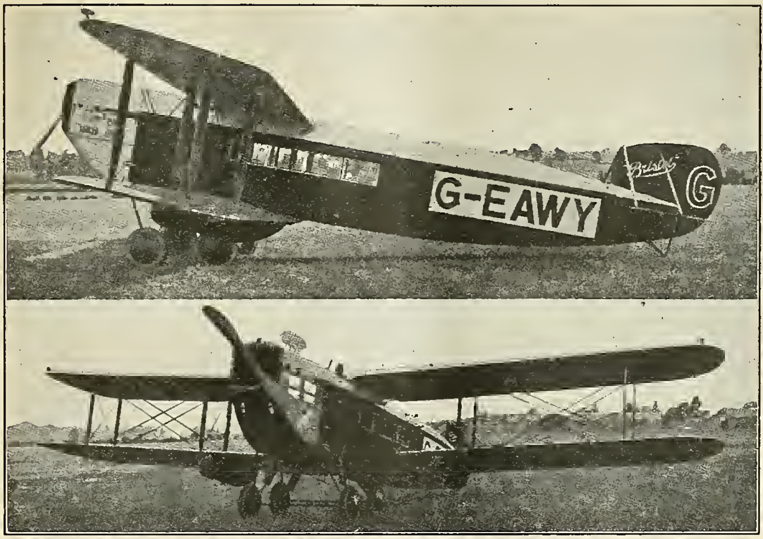
Hawker's Death Due to Paralytic Stroke

Harry Hawker lost control of his aeroplane owing to his physical disability. This was the verdict returned by the coroner's jury at an inquest on the famous airman.

Medical evidence was given that Hawker suffered from tuberculosis of the spine. A post-mortem examination showed that a hemorrhage had taken place, and the doctor came to the conclusion that as a result of the hemmorhage the airman became paralyzed and lost control of his machine.

A physician testified that Hawker had been advised not to fly for some time, that his physical condition was not strong enough for him to fly and take risks. Hawker did not realize, nor did his friends, how serious his condition was. His disease had advanced to such a point that the slightest movement or strain could have caused the final rupture which led to a hemorrhage. Hawker, as the physician expressed it, was absolutely on his last legs.

THE BRISTOL COMMERCIAL TEN-SEATER BIPLANE



Two views of the Bristol Commercial Ten-Seater

A NEW commercial type aeroplane has recently been completed by the Bristol Aeroplane Co.

This new Bristol is a large ten-seater single-engined tractor biplane, having an enclosed cabin for eight passengers and an open cockpit for pilot and mechanic.

The 450-h.p. Napier "Lion" engine, with which this machine is fitted, is on a readily detachable mounting which also carries the nose radiator and oil tank. Complete access to the engine can be obtained by releasing six self-locking fasteners, no part of the cowl being removed from the machine. Electric starting is fitted, as well as hand turning gear operated from the ground.

The *fuselage* is of deep rectangular section, with curved top deck, tapering to a shallow vertical knife-edge at the rear; the *fuselage* completely fills the gap between the planes. The saloon, or passengers' cabin, extends from the region of the front main wing spars well aft of the planes. Access to the cabin is by way of a door at the rear of the former, on the port side. Six of the passengers are located in separate seats, three a side, facing forward, and the other two passengers sit at the front end of the cabin facing aft. The seats are collapsible, and when folded project only five inches from the cabin sides, leaving a maximum of floor space should it be desired to carry cargo in lieu of passengers.

Windows, which can be opened, are fitted the full length of both sides of the cabin, and heating is provided by means of hot air muffs round the exhaust pipes. For the convenience of passengers liable to air-sickness a small concealed self-emptying basin has been provided in close proximity to each seat. These fold against the side of the saloon and are readily accessible, the waste pipe discharging through the floor.

In the roof of the machine a special emergency exit is provided, measuring 2 ft. 2½ ins. by 2 ft. 2 ins. This is operated by a quick release gear should occasion arise.

When it is desired to use the machine solely for the transport of cargo the space available is: length, 10 ft. 6 ins.; height at center, 5 ft. 9 ins.; width, 4 ft.

The pilot's and mechanic's cockpit is located high up in the *fuselage* at the leading edge of the top plane. An exceptionally fine range of vision is thus provided.

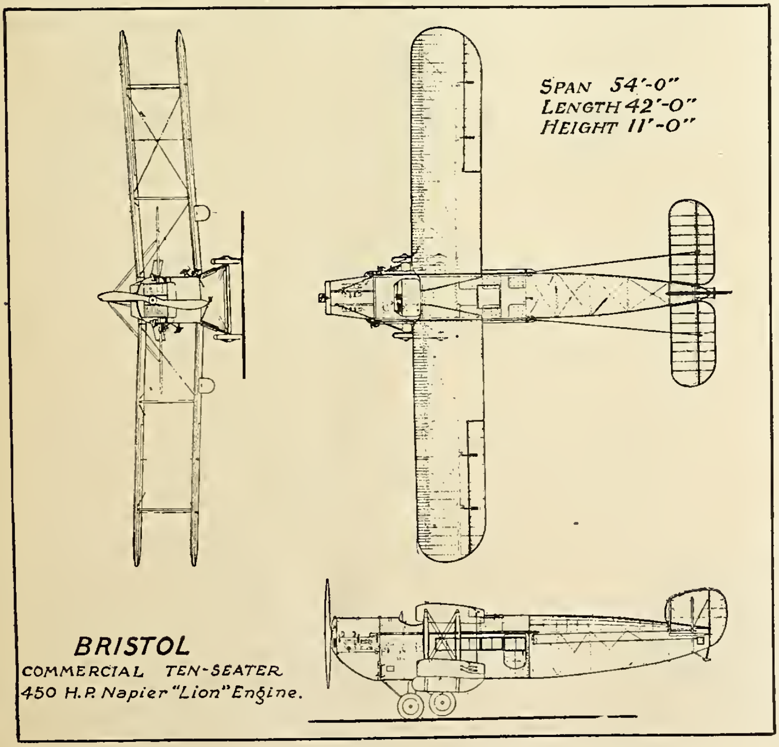
Below the pilot's cockpit is a compartment 4 ft. 6 ins. long by 4 ft. wide by 2 ft. 6 ins. high, accessible through a trap door in the underside of the *fuselage*. This is intended for the conveyance of passengers' luggage or for other suitable cargo.

Between the engine compartment and the pilot's cockpit is a steel fireproof bulkhead, and all control connections pass through glands. No petrol is carried in the body of the machine aft of this bulkhead.

In the pilot's cockpit a complete wireless telephone and telegraph installation is installed, and has been fitted so as to be completely accessible to the mechanic. In order to allow of communication between the pilot and the passengers a small trap door has been provided to allow of messages being passed when required.

Single control of the wheel type is fitted, all cable pulleys being five inches in diameter. The tail incidence can be varied by a lever and quadrant adjacent to the pilot, to trim the machine under all conditions of speed and load distribution. All control surfaces are unbalanced.

The main planes are of equal span and chord, and are without stagger or sweepback, but are set at a pronounced dihedral angle. The lower planes are attached direct to the sides of the *fuselage*, and the top ones to small wingroots in the roof of the cabin. There are two pairs of interplane struts each side, and the landing and lift bracing is by streamline wire. *Ailerons* are fitted to all four wings.



The chassis is of the four-wheeled Oleo-elastic type, with wheels in tandem, brakes being fitted to the rear wheels and operated by a car type brake lever in the pilot's cockpit. A gate is provided for the brake lever so that the brakes may be operated together or singly as required. Elastic rings are used for suspension and the elastic carriers have been designed for ready renewal of these rings. The Oleo plungers are fitted with a special type of tapered needle valve to control the passage of the oil through the plunger to give constant oil pressure throughout the stroke of eight inches.

The two main gasoline tanks, of 50 galls. capacity each, are slung under the bottom planes at the inner interplane struts. Gasoline is drawn from either of these tanks by two Vickers' centrifugal pumps coupled in series, and delivered through a Vickers' hand pump to the carburetors, any surplus passing to a 10-gall. gravity tank and overflowing back to the particular main tank in use. Smiths' capacity gauges for both main tanks are fitted on the instrument board.

The principal characteristics of this machine are as follows:—

Dimensions

Span	54 ft.
Length, overall	42 ft.
Height	11 ft.

Weights

As passenger machine—	
Machine empty with water	3,900 lbs.
Wireless installation	63 lbs.
Fuel and oil for 400 miles (100 galls. petrol, 6 galls. oil)	798 lbs.
Crew (two)	360 lbs.
Passengers (eight)	1,280 lbs.
Baggage (50 lbs. per passenger)	400 lbs.
	6,801 lbs.
As cargo machine—	
Machine empty, with water	3,800 lbs.
Wireless installation	63 lbs.
Fuel and oil as above	798 lbs.
Crew (two)	360 lbs.
Cargo	2,079 lbs.
	7,100 lbs.

Loading

As passenger machine—	
Weight/h.p. (Napier "Lion" at 450 h.p.)	15.1
Weight/sq. ft.	10.1
As cargo machine—	
Weight/h.p.	15.8
Weight/sq. ft.	10.6

Performances

	Full load.	Half load.
Speed at ground level	122 m.p.h.	124 m.p.h.
Speed at 5,000 feet	118 m.p.h.	120.5 m.p.h.
Speed at 10,000 feet.	114 m.p.h.	117 m.p.h
Time to climb to 5,000 ft.	9 mins.	7 mins.
Time to climb to 10,000 ft.	22 mins.	17 mins.
Ceiling	13,500 ft.	15,500 ft.

THE SPAD "BERLINE" S.33

THE Spad "Berline," type S.33 six-seater, is of interest in showing M. André Herbemont's ideas of a commercial aeroplane.

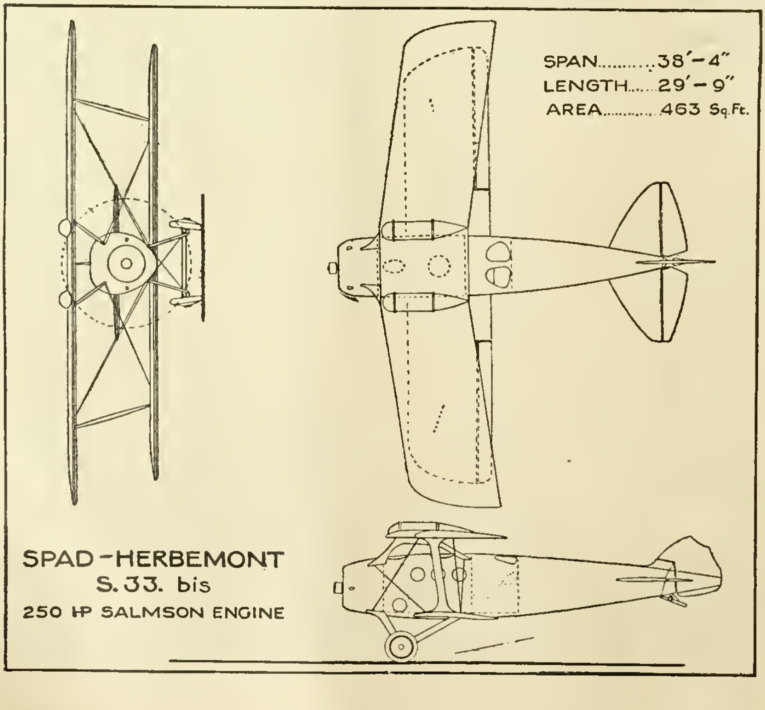
In general lay-out, the Spad 33 follows previous machines of Herbemont's design. That is to say, the *fuselage* is of the *monocoque* streamline type, the wings are characterized by a backswept top plane, and a single interplane strut on each side. The rudder is of that curious fin shape (piscatorial not aerodynamic) which has for several years been typical of the Spads. The *fuselage* is of fairly ample proportions, much more so than in the earlier types, where the passengers were very much cramped. Seating accommodation is provided for five passengers in addition to the pilot. The arrangement of the seats is reminiscent in a general way of that of the Westlands. That is to say, the pilot sits well aft, on the port side. Next to him, and on a slightly lower level, is a seat for a passenger, who, however, sits with his head projecting through the roof, instead of being inside, as in the Westland. In front of the pilot's cockpit, which is partly partitioned off, are two wickerwork seats, one behind the other, along the port wall of the cabin. On the starboard side are two more seats, placed back to back. On the whole the cabin is fairly comfortable, although of somewhat Spartan appearance. There is no upholstery and no padding, but the cabin, with its white walls and numerous windows and port-holes, is light and well ventilated. The door is near the front of the cabin, on the starboard side, and it must be admitted that it is in an uncomfortably close proximity to the propeller. In fact it would appear that, as there are no external fastenings for keeping the door open against the slip-stream from the propeller, it has been the object of the designer to prevent the engine being run until all the passengers are on board.

In the roof of the cabin, and just clear of the leading edge of the top plane, is a hatchway covered with transparent material. This hatchway is evidently intended as an emergency exit in case, for some reason, the door is jammed; also the cockpit next to the pilot affords a means of getting out of the machine, so that, even in case of alighting on the sea, there should be a good chance for the passengers of getting out safely. The *monocoque fuselage* would probably keep the machine afloat for a considerable time.

The engine, a Salmson A-Z9 nine-cylindered radial water-cooled, is known as one of the most reliable of French engines. It is variously known as a 250 and 275 h.p., but in reality it develops, we believe, about 300 h.p. at 1,500 r.p.m. The bore and stroke are 140 mm. and 170 mm. respectively, and the fuel and oil consumption amounts to approximately 0.56 lb./h.p./hour at full power. The weight of the engine, including magnetos and carburetors, but without water, is 660 lbs. As will be seen from the accompanying illustrations, the engine is neatly covered in, with a circular radiator in front of it. A small door in the front wall of the cabin gives access to the carburetors and magnetos from inside the cabin, thus doing away with the necessity of removing the cowling for the purpose of inspecting these two accessories. Furthermore, there is a circular opening in the lower part of the cowl itself.

The gasoline system is of the simplest possible. Two large gasoline tanks are placed on top of the upper plane, and the supply to the engine is by gravity from these main tanks, thus doing away with petrol pumps, and at the same time getting all the petrol away from the cabin.

As regards the performance of the Spad "Berline," the machine should be fairly economical to run, as the load carried per horse-power is fairly high. At the same time, the speed is not by any means bad,

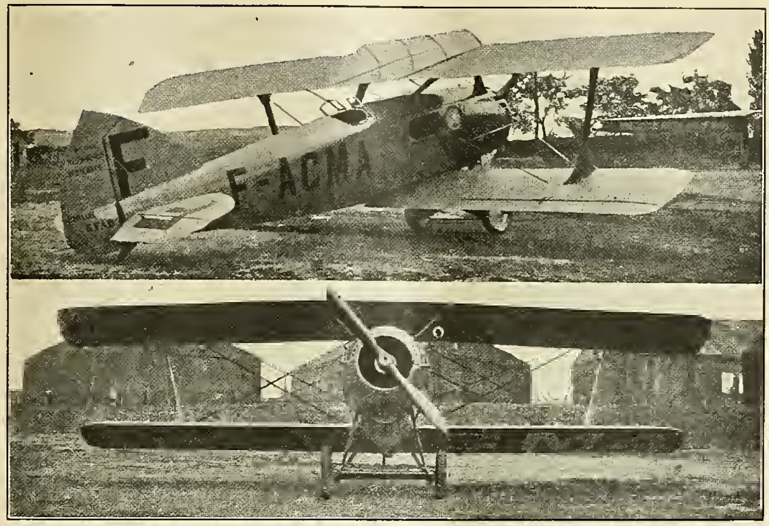


SPAD-HERBEMONT S.33. bis
250 HP SALMSON ENGINE

the top speed being in the neighborhood of 110 m.p.h., with a cruising speed of about 97 m.p.h. We have no information relating to the landing speed, but in view of the fact that the wing loading is approximately 9.5 lbs./sq. ft., the landing speed must be somewhat high. The machine is now in use by the *Messageries Aériennes,* alternating with the older types, and probably it is the intention of the management to substitute it, as requirements demand, for these.

Following are the main characteristics and performance data for the Spad 33:

Span, 38 ft. 4 ins.
Length overall, 29 ft. 9 ins.
Height, 10 ft. 6 ins.
Area, 463 sq. ft.
Weight empty, 2,200 lbs.
Useful load, 2,200 lbs.
Weight loaded, 4,400 lbs.
Load per sq. ft., 9.5 lbs.
Load per h.p. (300), 14.66 lbs.
Speed near ground, 110 m.p.h.
Speed at 3,300 ft., 110 m.p.h.
Speed at 6,600 ft., 109 m.p.h.
Speed at 10,000 ft., 105 m.p.h.
Climb: 3,300 ft. in 10 mins. 5 secs.; 6,600 ft. in 22 mins. 54 secs.; 10,000 ft. in 45 mins. 32 secs.



Two views of the Spad-Herbemont Commercial Biplane

THE PUEBLO FLOOD RELIEF EXPEDITION

THE expedition of three aeroplanes sent out from Post Field, Fort Sill, Okla., to render any assistance possible in connection with the flood at Pueblo, Colorado, serves to add to the already large field of usefulness in which the aeroplane can be utilized. The work expected of the planes sent to Pueblo was to patrol the Arkansas River, Fountain Creek and their tributaries and dams and keep the city informed in case a second flood or any dams or rivers gave way. The flight left for Pueblo on Sunday afternoon, June 5th, by way of Dodge City. The planes were equipped with machine guns, radio and photographic equipment, and piloted by Major Follett Bradley, A.S., First Lieutenant Fred C. Nelson, A.S., and First Lieutenant K. N. Walker, A.S., with First Lieut. Joseph T. Morris, A.S., and Sergeants Gall, Shepard and Corporal Brugh as passengers.

Skirting a number of heavy storms, the flight landed at Dodge City, Kansas, at 6:45 p. m., and found that city in a small state of excitement anticipating the flood which, it was contemplated, would reach there about noon the following day. Shortly after landing at Dodge City, a heavy rain began, which continued until 11:00 o'clock Monday morning, at which time the flight took off for Pueblo. Conflicting telegrams from officials of the State of Colorado as to servicing facilities were received by Major Bradley, who decided that it was advisable to land at Lamar, Colorado, approximately 90 miles from Pueblo, and take on additional gas in order that the planes would in no way be stranded when arriving at destination in case gas and oil could not be secured. Shortly after landing at Lamar, another heavy rain fell. During slight "let-ups" of the storm the planes were gassed, and at 4:00 o'clock the rain had subsided to such an extent that the flight again took off for Pueblo, following the river up to that city. No telegraphic communications could be received from Pueblo, but the Mayor of Lamar had been informed, in an unofficial way, that a second flood had struck Pueblo, worse than the first one, and that a five to ten-foot rise was on its way and requested that the radio operators be prepared to receive radio messages from the flight as to river conditions from Lamar to Pueblo. Radio communication was held with Ft. Lyons by Lieut. Morris. The rumor of the second flood proved to be unfounded, and Fort Lyons was requested to inform the towns east of the Fort that no further danger need be anticipated in connection with this second flood.

The flight arrived at ten minutes past five at Pueblo and flew over the city. The first impression of the city that one had from the air was that of a child's toy village which had been inadvertently kicked over by some careless foot. The business section of the town was the portion which had received all the damage. Box cars were strewn in all conceivable and inconceivable positions; in back yards of stores, upside down and crosswise of the tracks. Buildings seemed to be swinging at all positions from their original foundations. One lumber yard, which formerly occupied half a block, was strung over all of the lower part of the city. One steel bridge spanning the Arkansas River was broken in two and the sections lay alongside of each other. After circling the city, a landing field was selected four miles south of Pueblo's business district on the edge of the town and west of slag dumps of the Colorado Fuel and Iron Company. The field was an excellent one, nearly a mile long and half a mile wide, level as a floor, with hardly any disadvantages.

Colonel Hamrock, Adjutant General of the State of Colorado, arrived at the field shortly after the planes had landed, and the officers were taken to the Congress Hotel, at that time the headquarters of the Colorado National Guard and Colorado Rangers, who were in charge of the flood situation. Being located on high ground, this hotel fortunately escaped the flood. It was very crowded and very cosmopolitan in appearance. It seemed that everyone who had had any service whatever was wearing a uniform. Ex-emergency officers, National Guardsmen, Colorado Rangers, ex-Royal Air Force officers, Marines and Sailors thronged the place and, together with civilians carrying guns and wearing various kinds of badges, made quite an interesting spectacle. A dynamo of the flooded electric plant was put in operation, which furnished the hotel with light, the only building in town so furnished.

No flying being required the next morning, an inspection of the devastated district was made on foot. Dead animals and overturned automobiles were strewn about the city. The mud in some places was four and five feet deep. One Italian settlement was completely washed out; nothing but faint signs of former foundations being in evidence, and all buildings in direct line of the flood were either washed away or their foundations so shaken that they were unsafe to enter. Crews of men in rubber boots and armed with shovels were hard at work endeavoring to clean up the horrible mess. It is nearly impossible to visualize the destruction caused by the high water unless one were actually on the ground and witnessed it. The excellent spirit of the citizens, many of whom had lost everything, was remarkable.

In the afternoon patrols were made of the rivers for 50 miles, and favorable reports were returned to Military Headquarters. There were no further cloud bursts in the mountains, and no further danger from the river was imminent. Daily patrols were made until Saturday morning, at which time the Adjutant General released the flight so that it could return to Fort Sill.

Lieutenant-Colonel Cables, Engineers, requested that a mosaic map be made of Pueblo and a number of devastated mountain towns. An additional plane, more completely equipped for making mosaic maps, was requested from Post Field in order to effectively accomplish this mission.

The flight left Pueblo at 1:30, returning by way of Dodge City, arriving at Post Field at 8:45 p. m., making the return trip in six hours and fifteen minutes and bucking a strong wind all the way.

AEROPLANE FLIGHT ENDURANCE (1)

Aeroplane Flight Endurance (I)

Purpose

It is the purpose of this report to describe a chart which will serve as a ready means of determining for any aeroplane the minimum horsepower required or the maximum horsepower available at any altitude which it is possible for the aeroplane to reach. The construction of the present chart is based on the method of McCook Field Serial No. 1380 (Air Service Information Circular, Vol. II, No. 183), "Aeroplane Performance and Design Charts," and consists in combining several of the fundamental relations which are plotted in figures 2 and 5 of that report, to which reference should be made.

The chart should be useful in calculations of aeroplane-flight endurance for determining (*a*) the maximum time in the air with a given fuel supply at the altitude of minimum horsepower required; (*b*) the corresponding speed; (*c*) the fuel supply necessary for a given duration at any altitude, either at full power or with unthrottled engines. In addition the curves of horsepower at altitude as presented may be used to indicate absolute ceiling, and in the case of supercharged engines will provide a means for determining rate and time of climb in function of altitude, as well as service and absolute ceilings.

In duration flight problems it is necessary to know the unit fuel consumption as well as the horsepower. This report deals only with the latter and lays a foundation for flight tests conducted with the object in view of determining the variation of unit fuel consumption with throttle opening and altitude.

I. Minimum Horsepower Required

If the horsepower available from an aeroplane's engine were reduced until a condition was reached, such that the aeroplane could no longer climb from the ground, i. e., so that its absolute ceiling was at the ground, then that horsepower would be equal to the minimum horsepower required to sustain the aeroplane. The corresponding value of #/H. P. would be at its maximum within the range of flying ability. We can easily determine for any aeroplane this value of #/H. P.$_m$ (minimum required), study its variation with altitude and then convert it into the corresponding actual horsepower. The solution is entirely graphical.

In fig. 5, Air Service Information Circular, Vol. II, No. 183, is plotted absolute ceiling and corresponding speed in function of lbs./sq. ft. and #/H. P. corrected for "fineness." To find #/H. P.$_m$, it is only necessary to find on the absolute ceiling chart the intersection of the particular #/sq. ft. line with the zero absolute ceiling line, draw a horizontal to the particular "fineness," and drop a vertical to the #/H. P. at the ground scale. In Chart I of figure 1 this report is plotted the variation of #/H. P.$_m$ with #/sq. ft. for "fineness" 100, taken from the "Aeroplane Performance and Design Chart" as indicated above. Superposed on Chart I are various lines of "fineness," so that if we start with #/sq. ft., go horizontally to the #/sq. ft.—#/H. P.$_m$ curve, and if instead of reading

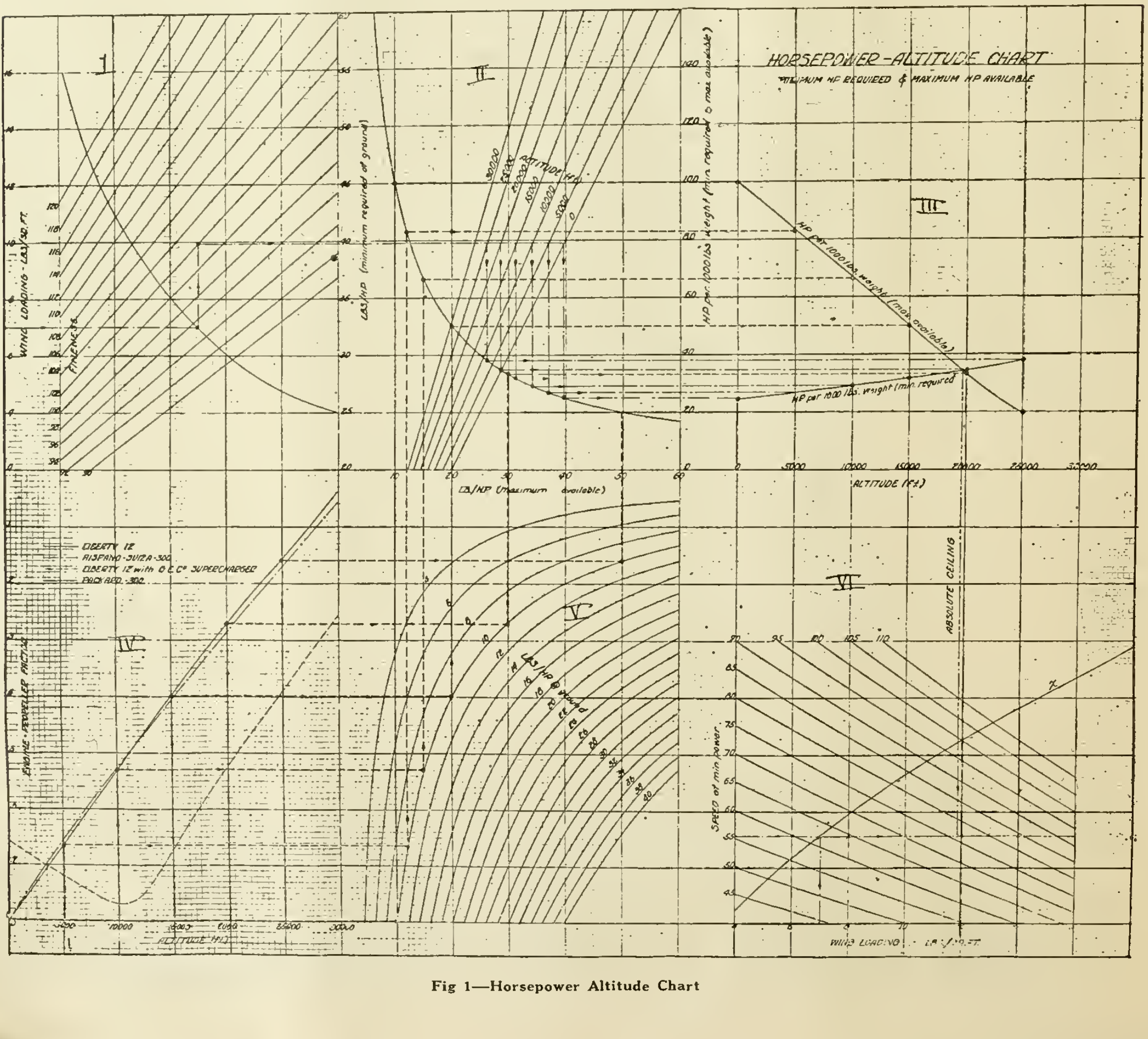


Fig 1—Horsepower Altitude Chart

#/H.P.$_m$ for "fineness" 100 as abscissae, we go next vertically to the "fineness" marked on the straight lines, thence horizontally to the right, we will find there the #/H. P.$_m$ corrected due to the particular "fineness." Since H. P. required varies inversely with (fineness)^3 (by definition), #/H. P.$_m$ varies directly with this factor and the straight lines of Chart I effect this multiplication.

At altitude, horsepower required, and hence its minimum value increases as the square root of the reciprocal of the relative density. Expressed in terms of loading per horsepower we have

$$\#/\text{H. P.}_m \text{ at altitude} = (\sigma)^{1/2}\ \#/\text{H. P.}_m \text{ at ground,}$$

where σ is the density at altitude relative to the density at the ground. Values are taken from Table I, which defines the standard atmosphere adopted by the engineering division. The altitude curves of Chart II, figure 1, effect this multiplication, so that if a horizontal from the #/H. P.$_m$ scale of Chart I were drawn to a particular altitude line, a vertical dropped from the intersection would indicate the #/H. P.$_m$ at that altitude. However, an additional curve has been introduced in Chart II, which performs a transformation from #/H. P.$_m$ to H. P.$_m$ per 1,000 pounds weight of the aeroplane, so that if from the point on the altitude line a vertical line is drawn to the new curve, a horizontal drawn from this intersection will indicate on the right-hand scale H. P.$_m$ per 1,000 pounds weight at the particular altitude.

Now in Chart III, figure 1, altitude is marked off as abscissae, so that we can plot the variation of H. P.$_m$ per 1,000 pounds weight in function of altitude, as we come from Chart II, having used various altitudes. Suppose that it is proposed to set up a record of endurance, considering maximum time in the air without landing. The weight empty of the aeroplane to be used is known, as well as the area and horsepower of the engine at the ground. "Fineness," if not known, is selected by comparison with the aeroplanes listed in Table II. Several weights fully loaded may be assumed and performances determined in each case by the method of Serial No. 1380, Air Service Information Circular, Vol. II, No. 183. In general the total weight will be limited by considerations of getting off; that is to say, rate of climb at ground, or by a minimum service or absolute ceiling defined by the topographical conditions of the vicinity in which the flight is to be made. The maximum total weight having thus been decided on, the weight of fuel it is possible to carry is known, due allowance having been made for possible additional tanks. Now to fly for the maximum time necessitates flying at minimum horsepower required at the particular minimum altitude, and the present chart, figure 1, will indicate this horsepower quantitatively. Now, if at that altitude and power the unit fuel consumption were known it would be possible to make an estimate of the possible endurance. Furthermore, reductions in total weight due to consumption of fuel can be taken into account, new H. P.$_m$ may be found as time in the air elapses, and by summation very close results may be obtained.

It might be an aid to the pilot to know at what speed to fly throughout the flight, in which case it can be found from Chart VI. the development of which is described in the following. Referring again to the absolute ceiling chart of figure 1, Air Service Information Circular, Vol. II, No. 183, we have in the zero ceiling line a surve of speed at zero absolute ceiling, hence speed at ground level at the altitude of minimum power required, with values of #/sq. ft. marked on the curve. This can be replotted with #/sq. ft. as ordinate and speed as abscissae with altitude as parameter according to the fundamental relation:

$$\text{V at altitude} = (1/\sigma)^{1/2} \text{ V at ground (constant incidence)}$$

In Chart VI, figure 1, the relation has been expressed in such a manner that if a vertical is drawn from the #/sq. ft. scale to the conversion curve χ, and a horizontal constructed through the intersection, than a vertical dropped from the altitude scale of Chart III, will intersect the horizontal, and indicate the speed at minimum power at the particular altitude. It is pointed out that although the above relations between speed and lbs./sq. ft., as well as between lbs./sq. ft. and #/H. P. in the foregoing, are taken from the Liberty engine chart, the same relations obtain for any engine, since at zero altitude no consideration of power drop-off with altitude, peculiar to any engine, enters into the discussion.

II. Maximum Horsepower Available

A variation of the method for determining engine horsepower with altitude has been given in Air Service Information Circular Vol II, No. 183, with results plotted as shown in Curves VI, figure 2, of that circular. The characteristic drop-offs found by the empirical-theoretical method, have been replotted in Chart IV of figure 1, with a curve of the Liberty "12" engine with G. E. Co. supercharger added. Charts IV and V are so arranged that if we start at any altitude as abscissae on Chart IV, draw a vertical to the particular engine curve, then a horizontal to the lbs./H. P. at the ground, a vertical from there would cut the top scale of Chart V, giving #/H. P. maximum available at the particular altitude. The lbs./H. P. curves, Chart V, simply multiply the lbs./H. P. at the ground by the reciprocal of the ratio of the engine propeller factor at altitude to the one at the ground, since, if H. P. decreases, then #/H. P. increases with altitude.

Now if we proceed from the first points on the lbs./H. P. lines of Chart V, vertically up to the conversion curve of Chart II, thence horizontally, we will find on the right-hand scale, H. P.$_m$ per 1,000 pounds weight, which can in turn be plotted against altitude in Chart III. Here is a means, then, of determining the actual horsepower of the engine for flight at full throttle at any altitude, and if the unit fuel consumption were known in function of altitude and horsepower or r. p. m., it would be possible to determine just how much fuel had to be carried for a certain flight endurance at high speed at any altitude. Such an endurance figure is generally specified for Army aeroplanes, and one of the purposes of this report is to provide a basis for a series of flight tests with the object in view of determining unit consumptions.

III. Cruising Flight

Instead of flying at high speed or full throttle and corresponding high unit consumption, it may be desired to fly with reduced throttle and at lower speed, but with a unit consumption so much lower that less fuel would be consumed in flying a certain distance. The latter condition of flight is more economical, though slower, and is called flight at crusing speed. Suppose we have set up the fundamental curves of Chart III for an aeroplane which is our example. At 10,000 feet, the maximum horsepower available is 66.5 per 1,000 pounds weight. Now suppose the engine is throttled to 50 H. P./1,000 lbs., what will be the speed in horizontal flight? Draw a horizontal from 50 on the right-hand scale of Chart II, from intersection with conversion scale drop a vertical through Chart V. Now draw a vertical from 10,000 feet, Chart IV, to the engine curve, thence a horizontal through Chart V, and the intersection with the previous vertical will indicate the corresponding #/H. P. at the ground. Using this value on the Performance Chart of Air Service Information Circular Vol. II, No. 183, figure 5, we can find the horizontal speed at 10,000 feet. Repeating this procedure for various throttle openings and altitudes, it will be possible to determine the best altitude and speed at which to fly most economically for a given distance.

IV. Supercharging[1]

In Air Service Information Circular Vol. II, No. 195 is described a method for finding the rate and time of climb, service ceiling and absolute ceiling of an aeroplane equipped with a supercharger. Rate of climb was first expressed in function of the ratio #/H.P.$_m$ /#/H.P.$_a$ for the aeroplane without supercharger, and then determined from this law for the aeroplane with supercharger and new values of the ratio. The solution was wholly analytical, whereas it can be made mostly graphical. In figure I we have set up the curves o fH.P.$_a$ an H.P.$_m$ with altitude. The ratio H.P.$_a$/H.P.$_m$ can be used for expressing rate of climb, since it is equal to the ratio #/H.P.$_m$/#/H.P.$_a$. Rate of climb depends on excess horsepower, so that the greater the horsepower available and the smaller the horsepower required, the greater the excess, the ratio, and the rate.

The intersection of the curves in Chart III, in any case, indicates absolute ceiling, since horsepower available just equals minimum horsepower required. When the rate of climb curve has been established for a supercharged job as outlined above, and in Air Service Information Circular Vol. II, No. 195, then service ceiling can be found when rate of climb equals 100 ft./min. Time of climb is obtained by integrating the rate curve.

V. Conclusion

The present chart provides a method upon which may be based a flight test program for definitely determining the unit fuel consumptions of engines in function of altitude and throttle opening or r. p. m. The importance of such data can not be disregarded, and once it is obtained by the method herein outlined, it can be used in conjunction with figure 1 to solve practically any problem of flight endurance. In the case of supercharged engines, figure 1 provides a basis for determining rate of climb, service, and absolute ceilings. Some interesting results may be found with regard to endurance at altitude of aeroplanes equipped with superchargers.

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[1] An analysis of the Effect of Supercharging.

TABLE I.—*Standard atmosphere.*[1]

Standard altitude	Temperature °centigrade	Percentage pressure	Percentage density	$\sqrt{\delta}$	$\sqrt{\frac{1}{\delta}}$
0	15.00	1.000	1 000	1.000	1.000
1,000	12 84	.965	972	.986	1.015
2,000	10 75	.930	.944	.972	1.030
3,000	8.71	.897	.917	.958	1.043
4,000	6 73	.864	890	.943	1.060
5,000	4 81	.832	.863	.930	1.075
6,000	2 95	.802	837	915	1.093
7,000	1.14	.772	811	.901	1.110
8,000	— .61	.744	.786	.887	1.128
9,000	— 2.30	.715	.761	.873	1.145
10,000	— 3.94	.689	.737	.859	1.164
11,000	— 5.52	.662	.713	.845	1.184
12,000	— 7.05	.637	.690	.831	1.205
13,000	— 8.53	613	.667	.817	1.226
14,000	— 9 97	.589	.645	.804	1.244
15,000	—11.35	.567	.624	.790	1.267
16,000	—12 68	.545	.603	.776	1.289
17,000	—13 97	.524	.582	.763	1.310
18,000	—15 21	.503	.562	.749	1.335
19,000	—16.40	.483	.543	.736	1.360
20,000	—17.56	.465	.524	.723	1.383
21,000	—18.67	.446	.505	.711	1.408
22,000	—19 74	.429	.487	.698	1.433
23,000	—20 77	.412	.470	.686	1.458
24,000	—21 76	.395	.453	.675	1.482
25,000	—22.72	.380	.437	.660	1.516
26,000	—23.64	.365	.421	.649	1.541
27,000	—24.52	.350	.406	.637	1.572
28,000	—25 37	.336	.391	.625	1.600
29,000	—26 19	.323	.376	.613	1.632
30,000	—26.97	.310	.362	.602	1.663

[1] Engineering Division.
Ground: 15° centigrade.
29.92 in. Hg.
0.07608# per ft.^{3}

TABLE II.

Aeroplane	Wgt.	Area	r.p.m. at ground	h.p. at ground	#/h.p.	#/ sq. ft.	High speed at ground	"Fineness"
Caproni Triplane	12,900	1,420	1,450	[1]1,050	12.3	9.1	100	90
G. A. X	9,748	1,004	1,788	866	11.25	9.7	105	90
LePere Triplane	8,577	872	1,700	834	10.3	9.8	112	92.5
Martin Bomber	10,225	1,070	1,665	832	12.3	9.6	105	93
Martin Bomber [2]	9,185	1,070	1,700	834	11.0	8.6	106	93.5
Martin Transport	10,225	1,070	1,665	832	12.3	9.6	106	94
Martin Torpedo	12,098	1,080	1,675	833	14.6	11.3	105	94.5
JN-4-D-2	2,016	353	1,450	90	22.6	5.7	73	96.5
Loening	2,639	214	1,900	343	7.7	12.3	143.5	99
DH-9	4,065	490	1,580	388	10.5	8.3	113.5	99
DH-4	3,920	440	1,630	400	9.8	8.9	120	100
Fokker D-VII	2,100	236	1,560	184	11.4	8.5	117	104
Spad 16-A	2,844	328	1,670	240	12.1	8.8	116.5	104
LePere Biplane	3,774	391	1,725	420	9.0	9.6	136.5	107
VE-7	2,095	285	1,730	183	11.6	7.4	116.5	108
SE-5	2,090	245	1,725	180	11.4	8.4	121.6	108
Ordnance "D"	2,432	261	1,885	341	7.1	9.3	147	108
Junker L-6	3,605	417	1,445	243	14.8	8.6	111.2	108
U. S. XB-1A	2,994	406	1,730	316	9.5	7.4	124	109
Thomas-Morse MB-3	2,094	252	1,835	338	6.2	8.3	152	113
VCP-1	2,669	269	1,925	347	7.7	10.0	154	114
Thomas-Morse S-6	1,477	206	1,260	85	17.4	5.0	97	117

[1] Low compression Liberty "12's."
[2] Without bombs.

Air Service Information Circular.

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The stated monthly meeting of the Club was held in the Club Room, 1026 Walnut St., evening of July 15th. Lieutenant John Sydney Owens, chairman of the committee which was appointed to organize the local reserve flyers into an active unit, gave a most interesting report of the progress which had been made. Realizing the importance of the plane in modern warfare and the urgent need of an aviators' training field in this section for reserve flyers to continue their training and in some cases complete their instruction, the club fully discussed plans whereby it is hoped they can lease the large aviation field at Bustleton.

The Bustleton field has been abandoned by the air mail service and the local reserve aviators which are now being organized into an active unit desire to secure the field for instruction purposes. The field is ideal for the purpose, being well located, readily accessible and with large hangars already on the ground no preparation would be necessary for the housing of the two or three training planes which the Government would undoubtedly furnish.

Many of the reserve flyers in this section who won distinction in the late war have not figured in a flight since the armistice and an opportunity should be given these men to continue their training in preparation for another emergency.

Should the Club lease the Bustleton field as a training field it will be released to the Government at the rental of one dollar a year.

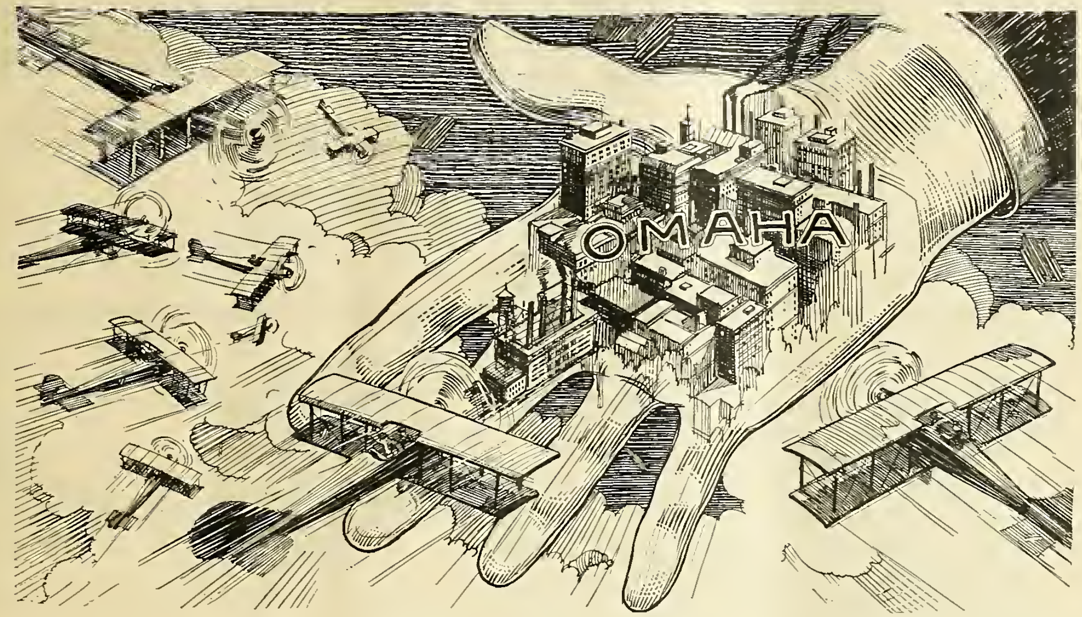
Mr. Frank Leahy, chairman of the Committee on Emblems, reported that the bronze emblem, in design similar to the Club badge, was nearly completed. It is planned to place same on the entrance to the club house where it will no doubt attract considerable attention. The design is of the badge, in about a ten by twelve inch size, border, lettering and figure in relief bronze with background of blue enamel. The central figure will be a flying witch on a broomstick. This has been the insignia of the Club from the time it was organized in 1909.

Mr. Hower, chairman of the Entertainment Committee, reported that he is making an effort to hold the August meeting of the Club at Kennett Square, Pa., the latter part of the month. The plans have not been fully made but every effort is being put forth to have the Club hold a Field Day meeting. Mr. Hower, who is managing director of the Philadelphia Aero-Service Corporation, will have one of his planes fly over from the Warminster field, and The Curtiss Eastern Airplane Co., controlled by Mr. Geo. S. Ireland, a director of the Club, will no doubt fly one of their ships over to Kennett Square from their field at Pine Valley, N. J. To further add interest to the event, J. Sydney Owens will take to the meeting two or three of his most expert model flyers in the Boy Scouts of Philadelphia.

The body of Captain Hobart Baker, former Princeton football star, was among the war dead brought from France on the transports Somme and Wheaton. "Hobey" Baker, as he was lovingly called by all his friends, was killed in December, 1918, near Toul, the day before he was to leave for home. His plane developed engine trouble at a low altitude and crashed before he could regain control.

He brought down three German planes during the last ten days of the war. The French Government awarded him the Croix de Guerre.

W. H. SHEAHAN,
First Vice-President.



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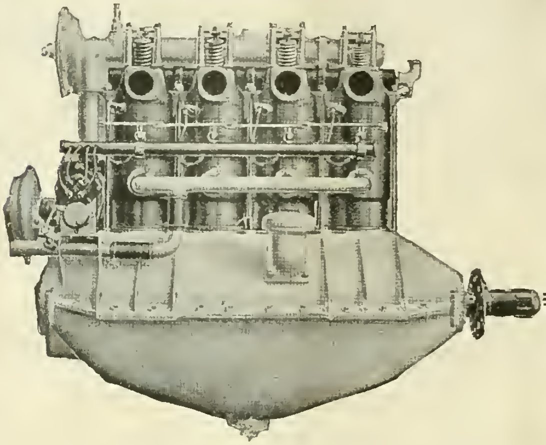

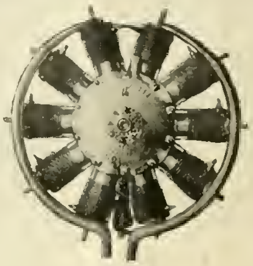

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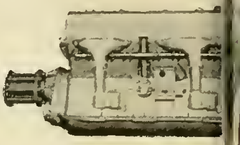

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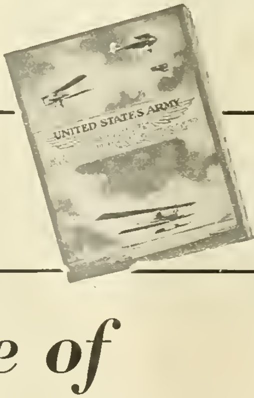

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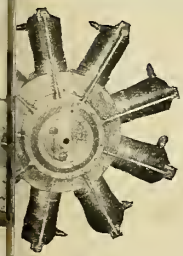
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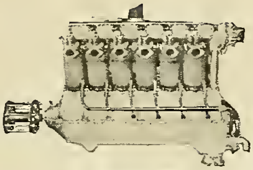
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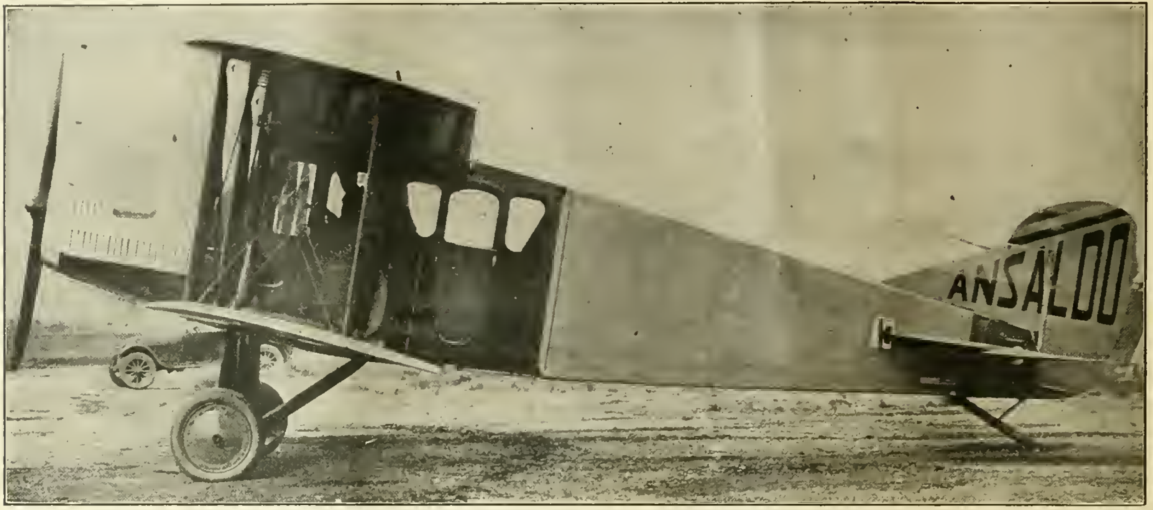

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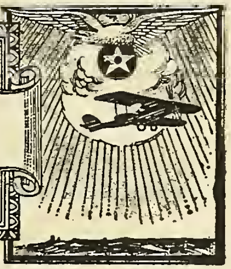


Army Review at Langley Field

Langley Field, Va.—Sixty-one planes of the First Provisional Air Brigade, nearly all of which shared in the bombing attacks on the ex-German destroyer G-102, were marshaled July 14 in review at Langley Field for the benefit of foreign naval attaches and Congressional and other guests of the navy.

The total number of army aeroplanes and airships of various types used in the operations against the G-102 was fifty-six and the average flying time for them all was two hours and forty minutes for the round trip from Langley Field to the target. All but three of the planes flew to the target and back without mishap. These three were compelled to make forced landings, but not one of them fell into the water.

Members of Congress, newspaper men and others in the reviewing party who wished, had an opportunity to ride in pursuit, light and heavy bombardment planes for a birds-eye survey of the Langley Field base. In an address to the visitors Colonel Milling told something of the ambitions of the army airmen for utilization of aircraft for coast defense. He said that while the Martin bombers were now able to carry a 2,000-pound high explosive bomb, a 4,000 bomb was being developed. The Martin bombers, which are generally called heavy bombers, would soon be shown to be light bombers. He predicted that in the event of a naval attack on the Atlantic coast, the army would be able to muster there within thirty-six hours all the planes east of the Pacific, and in less than twenty-four hours all the planes east of the Mississippi would be available for mobilization along the Atlantic.

Air officers thought the outstanding lesson from the destroyer attack was that more than fifty planes demonstrated their ability to fly to a point at sea ninety-seven and a half miles from base. Colonel Milling predicted that the army would be able to send planes out more than 150 miles from shore within a few years, with safety, for bombing attacks.

Among the visitors were Air Commodore Charlton of the British Embassy, Lieut. Commander Hubino, Japanese Naval Attaché; Colonel Vacarezza, Argentine Military Attaché; Lieut. Col. Guidoni, representing Italy, and representatives of the Brazilian and Cuban navies, and Representatives Sisson, Herrick, Davis, McClintock, Collins, Lineberger and Hamilton Fish, Jr., of New York.

Changes in Station of Air Service Troops

Orders were issued by the War Department transferring the following Air Service troops, effective June 30th:

From Kelly Field to Ellington Field, Houston, Texas:
- 1st Group Headquarters.
- 17th, 27th, 94th and 95th Squadrons.
- Air Park No. 2.

To Kelly Field, San Antonio, Texas:
- Flight "A," 90th Squadron, from Del Rio, Texas.
- Hqrs. and Flight "B," 90th Squadron, from Sanderson, Texas.
- Hqrs. and Flight "A," 8th Squadron, from McAllen, Texas.
- Detachment, 8th Squadron, from Laredo, Texas.
- Flight "B," 13th Squadron, from Marfa, Texas.
- Hqrs. and Flight "A," 13th Squadron, Hqrs. Detachment 1st Surveillance Group, and Photo Section No. 1 from El Paso, Texas.

(Three men will remain at each border station abandoned).

From March Field, Riverside, Calif., to Kelly Field:
- Detachment of 200 enlisted men, or such part thereof as may have six months to serve.

From Chanute Field, Rantoul, Ill., to Bolling Field, Anacostia, D. C.:
- One Staff Sergeant and 29 privates from School Detachment.

From Mather Field, Sacramento, Calif., to Ellington Field, Houston, Texas:
- Detachment of 200 enlisted men, or such part thereof available with at least six months to serve.

From Montgomery Air Intermediate Depot, Montgomery, Ala.:
- Air detachment demobilized and personnel, approximately 53 enlisted men, sent to Ellington Field.
- Four Staff Sergeants, 10 privates, 1st class, and 46 privates to Carlstrom Field.

From Selfridge Field, Mt. Clemens, Mich.:
- Supply detachment demobilized, and the four men sent to Scott Field, Belleville, Ill.

From Aberdeen Proving Ground, Md., to Mitchell Field, L. I., New York:
- Twenty unassigned privates, no men with less than 6 months' service to be sent. Casual detachment of two men from Governors Island, N. Y., to Mitchell Field.

From Rockwell Field, San Diego, Calif., to Post Field, Fort Sill, Okla.:
- One Staff Sergeant, one sergeant, one corporal, 25 privates, 1st class, and 275 privates; no men with less than 6 months' service to be sent.

Opening of Air Service R. O. T. C. Camp

The first Air Service Reserve Officers Training Camp opened at Post Field, Fort Sill, Oklahoma, on June 16, 1921, thereby marking an epoch of development in the Air Service preparedness program. There are thirty-one students at the camp—twelve from the Massachusetts Institute of Technology, five from the Georgia School of Technology, two from the Texas Agricultural and Mechanical College, seven from the University of Illinois, and five from the University of Washington. Students who are enrolled in the Air Service R. O. T. C. units at educational institutions, and who have completed two years of Air Service work are eligible for the camp if they are physically qualified to pass the 609 examination (medical examination to determine fitness for pilot duty).

At this advanced camp the students are taught aerial observation, and receive theoretical and practical instruction on the ground and flying experience in DH-4B planes as observers. The course of instruction lasts six weeks, and includes Visual Reconnaissance, Radio, Aerial Gunnery, Photography, Meteorology, trap shooting, infantry drill, and calisthenics.

The administrative personnel of the camp is composed of the officers attached to the six R. O. T. C. units who have been ordered to Post Field for this temporary duty.

New Navy Honorable Discharge Certificate

The new honorable discharge certificate which is now being distributed to ships and stations by the Bureau of Navigation, is handsomely engraved and printed on heavy paper of a parchment texture. Its striking feature is a reproduction of an engraving of the new type of battleship, the letters being in Old English and Script. A feature of the new certificate is the blanks on the reverse side allowing notations of service performed, the vessels, stations and service included, also campaigns and engagements in which the sailor participated.

Changes in Station of Officers

June 22, 1921—First Lieutenant Charles G. Brenneman, Air Service, ordered from the Aviation General Supply Depot, Washington, D. C., and directed to report to the Chief of Air Service, for duty in his office.

June 24, 1921—Major John C. McDonnell, Air Service, ordered from Aberdeen Proving Ground, Aberdeen, Maryland, to Ft. Sill, Oklahoma, for temporary duty at the advanced training summer camp; thence to proceed to Cambridge, Mass., for duty as Assistant Professor of Military Science and Tactics at the Massachusetts Institute of Technology, Cambridge, Massachusetts.

June 29, 1921—Major Earl L. Canady, Air Service, relieved from further observation and treatment at Walter Reed General Hospital, Tacoma Park, D. C., and ordered to Langley Field, Hampton, Virginia, for duty.

July 1, 1921—Captain Harold M. McClelland, Air Service, relieved from further duty as Student at Ft. Sill, Oklahoma, and directed to report to the Commanding General, Ft. Sill, for duty as Instructor.

July 2, 1921—First Lieutenant Eugene L. Vidal, Corps of Engineers, detailed to the Air Service and directed to proceed from Camp Humphreys, Virginia, to Carlstrom Field, Arcadia, Florida, reporting to the Commandant, Air Service Pilot School, for duty and pilot training July 28, 1921.

July 5, 1921—Major Roy S. Brown, Air Service, ordered from San Francisco, California, to Camp Benning, Georgia, to assume command of Air Service troops.

July 5, 1921—Captain Lewis A. Page, Air Service, relieved from further duty with the Air Service at Carlstrom Field, Arcadia, Florida, and returned to Infantry.

FOREIGN NEWS

Aircraft Material to Be Surrendered by Germany

On June 18 the Ambassadors' Conference, it is announced, decided that Germany must as soon as possible deliver up to the Allied Air Control Commission all aeroplane material manufactured contrary to the Boulogne decisions.

Everything described by the Commission as military material will be handed over to the Entente. Of the civil material only 25 per cent will be thus handed over. The remainder will go back to Germany as soon as the German Government is authorized to resume the building of aircraft.

French Customs Aerodromes

The Director-General of Customs announces that Customs clearance of seaplanes imported from abroad by the Mediterranean may be carried out at the Antibes station (S.N. Ae.). Seaplanes alighting from abroad may carry out Customs formalities at the Antibes station and the following Mediterranean ports: Mentone, Monaco, Villefranche-sur-Mer, Nice, Cannes, Saint-Raphael, Saint-Tropez, Marseilles, Saint Louis-du-Rhone, Cette, Port-Vendres.

French Aeronautical Gazetteer

The Governments of France, Belgium and Great Britain having agreed to compile Aerial Gazetteers of the aerodromes, seaplane bases and facilities for air navigation existing in their respective countries, the French Civil Aviation authorities have commenced the issue of Gazetteer sheets in the "Bulletin de la Navigation Aérienne." Sheets with regard to Valenciennes (Secondary Air Station) and Bayonne (Customs Seaplane Station) were issued in the "Bulletin" of April.

Palestine to Mesopotamia by Air, Via the Arabian Desert

A new air route has been opened up across the desert between Palestine and Mesopotamia, it is announced by the Air Ministry, and notification has been received of the arrival at Bagdad of three aeroplanes of the Royal Air Force, which have flown over this route. These machines formed part of a reconnaissance party that set out from Palestine on June 1, with the object of establishing a more direct line of connection between the existing aerodromes at Ramleh, in Palestine, and Bagdad, in Mesopotamia.

The length of the new route is about 590 miles, which is considerably shorter than the more northerly route formerly used. The line followed, which is an extension of the present Cairo-Ramleh route, starts from Ramleh, which is the main R.A.F. aerodrome in Palestine, passes through Amman, in Transjordania and Kasrazrak, where landing-grounds have been prepared, and proceeds thence in an almost straight line across the Arabian desert to Ramadie, on the Euphrates, and on to Bagdad. The last few intermediate ground stations for use in case of forced landings will be completed shortly. The distances between the principal stations are as follows:

Ramleh-Amman	65 miles
Amman-Kasrazrak	55 miles
Kasrazrak-Ramadie	400 miles
Ramadie-Bagdad	60 miles

The rest of the party traveled by cars, the aeroplanes co-operating with the ground detachment in selecting the most suitable air route. The landing-grounds chosen were then marked by the party for future use.

Coupe Deutsch

The eliminatory race for the French team to fly for the Deutsch Cup will take place on September 28 over 100 kilometers on the Cup Course: Villesauvage-La Marogue.

A Belgium Altitude Record

The Commission Sportive de l'Aèro Club de Belgique have confirmed, at the session held on the 13th inst., an altitude record for Belgium, established on the 6th inst., at Haren aerodrome, by M. Lovadina, who, on a 220 h.p. Ansaldo machine, reached an altitude of 7,907 m. (25,943 ft.). They have also presented him with the silver-gilt *plaquette* of l'Aèro Club de Belgique.

A French Height Record

From *l'Auto* we learn that Georges Kirsch created a new height record on June 14 last, when, on a 300 h.p. Nieuport (Hispano), he reached an altitude of 9,800 m. (32,153 ft.), thus beating the previous record, held by Casale, of 31,216 ft.

To India by Air in Six Days

Plans are now being made for a great flight by R36, England's latest and largest Airship, to Malta, Egypt and India. All sorts of proposals are being considered at this time, and instead of a trip to India it may be decided to make a non-stop journey to Malta and return. Should a decision be reached to make the trip to India, however, the R36 will make a stop in Egypt for replenishment of fuel. It is expected that the flight to India will take six days. The fastest time by rail and steamer is 21 days.

Dutch Aerodrome

The largest aerodrome in Holland has recently been established at Rotterdam, seven miles from the city. It is rather more than 1,100 yards long by 700 wide and, being perfectly flat and open, is well suited to the requirements of aircraft. A temporary railway has been made to bring gravel and other building material to the site, where a large shed has already been erected. Offices have been put up and premises for Customs, wireless, meteorological observation, a restaurant, and a tower for illumination by night are either already in existence or projected. The whole has been planned on data embodying the latest experience.

German Air Lines Run by Time Table

Germany has completely inverted the metaphorical expression, "It's all in the air," with its implication that the subject referred to is only a nebulous project, for Germany really is in the air, at any rate, its aeroplanes are there every day, and almost every hour of the day, according to a N. Y. *Times* correspondent.

A few days ago, feeling, so to speak, in a flighty mood, I called at the Travel Bureau, on the Unter den Linden. Within an hour I had been motored to an aerodrome outside the city, had been strapped into an aeroplane, and from 1,000 feet above was looking down on the white ribbon of road where I had been standing just before. That was a casual affair, improvised at a moment's notice, but if I had wished I could just as easily and with equal certainty have booked a place in an aeroplane the next day for any big city in the country.

On my desk is an aerial time table, so far as I know the first complete publication of its sort in history. Its mere existence, not to speak of its contents, is surely a striking witness to Germany's development of aerial transport. A substantial booklet of nearly a hundred pages, it is as matter of fact and substantial as Bradshaw's European Railway Time Table.

Fourteen pages alone are filled with the details of regular daily or twice daily services to places within the borders of Germany. They give to the minute the times of departures and arrivals. There is not even a saving clause about wind and weather permitting, so that it requires quite a mental effort to realize that before one are the pathless tracks of the air and not steel railroads.

By arrangements with Holland and other neighboring countries long distance services are linked up with England and Scandinavia. There is a map which shows at a glance the principal daily services inside Germany and their communications with overseas routes.

To this regular passenger transportation all sorts of subsidiary services are being added. The flying post, for instance, is rapidly developing, especially as it is not burdened with any special regulations apart from a slightly higher tariff. All one has to do to insure this speedy delivery is to mark the letter "by flying post," and drop it into any letter box in the ordinary way. In this matter, too, international arrangements have been made so that a letter posted in Berlin at 7:30 o'clock in the morning reaches London, for example, at 5:30 the same evening.

One interesting use of the aeroplane, to which special attention is directed, is for keeping the rest of Germany in swift touch with the lost territories, such as Danzig, or areas like Memel, whose fate is not yet determined, so that the populations of these districts shall not cease to imbibe the true gospel of Deutschtum.

Aeroplanes leave Berlin early every morning loaded with newspapers. Hydroplanes serve the same purpose for the Island of Sylt, off the coast of Schleswig, leaving Hamburg immediately on the arrival of the Berlin journals by train.

Reverting to the aerial Bradshaw, a glance at the advertisements reveals still further enterpirse. Here, for example, is the Hamburg-American line offering its own services to any town in Germany. It will send passengers or goods by special aeroplanes available to start at the shortest of notice. Another firm supplies aerial photographs, suggesting their particular desirability for enterprising financiers on the lookout for suitable sites for establishing new settlements and spas.

Unusual Italian Monoplane

An aeroplane capable of landing without the need of a large aviation field, able to rise without a long run beforehand, able to travel more than 300 miles an hour and, if necessary, to meander along at but a few miles an hour, is announced as the invention of an Italian engineer, Epaminonda Bertucci of Rome.

The inventor claims that he already tried out the machine on a small scale and regards his first experiments as indicative of the success of the invention. The new machine is primarily intended for aerial war chasing and is to be armed with a machine gun. It is a monoplane.

Touring by Aeroplane in Australia

Particulars have just been received from Australia of some extensive flights by an Avro machine fitted with a 100-h.p. Sunbeam-Coatalen "Dyak" engine. This machine is the property of Mr. P. Hogarth, of Richmond, North Queensland, who has purchased it for the greater convenience of visiting his large properties in Australia, and in view of the undeveloped nature of the country in many parts touring by motor-car or cart is scarcely practicable and an aeroplane is much more expeditious. Recently Mr. Hogarth took delivery of the machine at Sydney, and flew home, a distance of 1,845 miles, in 20 flying hours, averaging 92 miles per hour. Another machine of similar type has covered well over 10,000 miles in something like 150 hours actual flying time, and the only work necessary to be done on the engine was to grind the valves in twice. Both petrol and oil consumption were very satisfactory, and little doubt is felt but that the machines will prove thoroughly successful, and the example by Mr. Hogarth will be widely copied by the wealthy squatters of Australia.

Supply of Caproni Machines

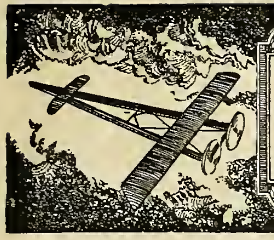
Owing to the satisfactory results of a 600-h.p. Caproni the Government of Peru is ordering from Italy a second machine of the 300-h.p. type.

New German Air Mail Lines

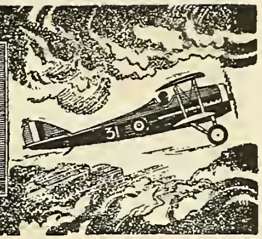
According to a notice just issued by the German Postal Department there will, from July 1 on, be an air mail parcel service between Germany on the one hand and Holland and the Danzig and Memel districts on the other. (The Memel district, of course, is Eastern Prussian territory separated by Polish territory from the bulk of the country.) However, only urgent parcels will be admitted for transmission by air, an extra fee of 25 marks on the German-Dutch line, and 10 marks in the case of the Danzig and Memel lines, being charged for each kilogramme or fraction of a kilogramme. The custom-house formalities will be hastened as far as possible, so that parcels may in most cases reach their addresses on the very day they are dispatched.

German Air Mail Safety Service

The German Postal Department has made elaborate arrangements throughout its air mail lines to secure the safety of aircraft and their passengers and pilots. The Aeronautical Observatory at Lindenberg has been set apart as central office for all meteorological information, to which the observers on each air-line section at 8 o'clock every morning send a telegram comprising a number of figures from which all desirable data as to the meteorological condition at the place of observation can be derived. Places of observation are so chosen as to lie close to the dreaded weather limits, so that any danger to airmen may be detected as early as possible. The data communicated by postal officials are worked out at the Lindenberg Observatory as warnings for transmission to postal aircraft pilots. This weather service for the benefit of the air mail is entirely free of charge.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Early Aeroplanes

WHAT is regarded as the first machine built on aeroplane principles was built in 1843 by an Englishman named Henson. His machine consisted of a light framework of wood, 100 feet wide and 30 feet in length. The covering was of silk. A rudder shaped like the tail of a bird was used to steer it in a vertical direction. This rudder was fifty feet long.

Underneath the main wing (which was really a sail) a car was placed which contained the steam engine and the passengers. The machine was driven by two tractor propellers located on either side of the pilot. The engines were regulated to be adjusted to assist in turning to the right and left. The engine gave twenty horsepower. While Henson's design showed much promise of success, the horsepower and the type of propeller used were entirely insufficient for flight.

The Phillips' Aeroplane

A flying machine of curious form was constructed in 1862 by Horatio Phillips, also an Englishman. In this machine a number of narrow surfaces with long leading edges were carried in a frame in somewhat of the manner of Venetian blind. The height was 9 feet, 3 inches and the span was 21 feet, 8 inches. The entire machine was mounted upon a wheeled carriage, shaped like a boat, and 25 feet in length.

The machine was operated over a circular board track, 600 feet long. The machine was anchored by a rope to the middle of the track. The weight was under 300 pounds. Experiments showed that a load of 72 pounds placed above the front wheels could be lifted 30 inches in the air. These experiments proved that the construction principles were correct, but after a few experiments of this sort the work was abandoned.

Maxim's Steam Engine Aeroplane

Some very interesting experiments were carried out by Sir Hiram Maxim in 1888, whose large aeroplane cost more than $100,000. His machine had a large sail or plane with a number of smaller wings at either side of it. The combined area of all the wings was 3,875 square feet.

A framework built of thin steel tubes connected the wings to a platform measuring 40 feet by 8 feet. This framework formed a support for the boiler and engine. The vertical movement of the machine was controlled by two horizontal planes, one placed at the front and one at the rear. The horizontal control was managed by two planes inclined to one another at an angle of 7.5 degrees, and arranged so that they could be raised and lowered with a resulting shifting of the center of gravity, causing an alteration of the flight.

Its weight complete was 7,000 pounds. For purposes of testing it was mounted on two pairs of wheels set on a railroad track. An additional rail was placed above the machine to control the upward movement.

Propellers were 17 feet, 6 inches in diameter. When the steam pressure in the boiler reached 350 pounds pressure enough power was generated to cause the machine to rise from the lower rails and come in contact with the upper one. During one of the tests the upper rail was broken away and the machine flew across the field, landing in such a way as to cause its partial destruction. A dynamometer test showed that a weight of 5,000 pounds would have been lifted, truly a remarkable performance for that early date.

Other Early Planes

At the Paris Exposition in 1900, a machine devised by a well-known French engineer, named Adder, was exhibited for the first time. Its planes or wings could be folded back; they were like a bat's wings. Two four-bladed propellers were used, driven by a compressed-air motor.

Although this plane weighed more than 1,000 pounds, it could lift itself from the ground and make short hops.

Another machine built by Kress was tested in Austria in 1901. It showed promising results. The experiments of Professor Langley, at Washington, D. C., resulted in the first flight of a heavier-than-air craft of more than a mile, on December 12, 1896.

The problem of soaring flight was being studied by Otto Lilienthal, a German, the Wright Brothers, Chanute and Herring, Americans. The results of these tests proved of great value in power-driven flights later on. It was in 1903 when the Wright Brothers built their glider which was equipped with a gasoline engine. Their progress from that time on was very rapid for they had gathered considerable useful information which was kept secret for a long while and it was not until later that it was realized that they had progressed so far beyond their contemporaries.

Air Resistance

Careful experiment has proven quite conclusively that air resistance increases as the square of the velocity. This means that at ten miles an hour the resistance of the atmosphere is four times what it was at five miles an hour. At a speed of fifty miles an hour (10 times the speed of five miles) the air resistance is 100 times as great. The wind pressure is approximately 50 pounds per square foot when moving at the rate of 60 miles an hour. From this basis, the indication of almost any speed can be found to a reasonable degree of accuracy.

The table below gives the work required to move a body through the air per square foot of "frontal area" or surface exposed at right angles to the flight path, and should assist those who desire to calculate the resistance of any kind of aircraft:

Miles per hour	Feet per second	H. P. required per sq. ft.
10	14.7	0.013
15	22	0.044
20	24.6	0.105
25	36.7	0.205
30	44	0.354
40	58.7	0.840
50	73.3	1.640
60	87.9	2.830
80	117.3	6.720
100	146.6	13.120

Illinois Model Aero Club Notes

The semi-annual election of officers of the Illinois Model Aero Club was held on July 1st. The following is a list of officers elected and re-elected at that time:

President, L. Chatroop; Vice-President, H. Wells; 2d Vice-President, W. Brock; Secretary, R. Jaros; Treasurer, L. Davies; Corresponding Secretary, B. Pond; Contest Committee Chairman, W. DeLancey.

These new officers, as well as all the other members of the I. M. A. C. have pledged themselves to do all in their power for the advancement of model aeronautics. This pledge has been lived up to as shown by the flying records of the members whose flights have been made with real consistency.

Although the I. M. A. C. is not conducting a particular membership campaign at the present time, several of the old members are leaving for out-of-town universities, etc., and this leaves quite a gap in the membership rolls. An opportunity is therefore called to the attention of young men near Chicago who are interested in model flying, as the I. M. A. C. will welcome new members to fill up its ranks.

The I. M. A. C. will be represented at Chicago's "Pageant of Progress" Exposition, and model fliers visiting there are invited to become acquainted with the Club's representatives.

A-E-R-O-N-I-T-I-S

The Song of the "Jennie"

Tune of "Oh Johnnie"

Oh! Jennie, Oh! Jennie
How you can fly!
Oh! Jennie, Oh! Jennie
You take my eye.
You've got the others beat a mile,
Although you're not so much for style.
Oh! Jennie, Oh! Jennie
You'll do to fly
Because you are so very safe.
Oh, you're fast it is true
But when I climb in you
Then it's Oh! Jennie, Oh! Jennie Oh!

Lawrence Russell, Age 14, Omaha, Nebr.

Rather Fishy

There was a young fellow named Fisher,
Who was fishing for fish in a fissure,
When a cod, with a grin,
Pulled the fisherman in:
Now they're fishing the fissure for Fisher.

Cause Enough

Smith: What is the matter with Brown? Every time he sees an aeroplane he trembles and grows pale with fright.

Jones: Oh, his wife eloped with an aviator.

Smith: And when he sees a machine in the air the recollection causes him pain?

Jones: No, no! He's afraid it's bringing her back.

Not Possible

When a lady who was "burning up the road" on the boulevard was overtaken by a traffic officer and motioned to stop, she indignantly asked: "What do you want with me?"

"You were running 40 miles an hour," answered the officer.

"Forty miles an hour? Why, officer, I haven't been out an hour," said the lady.

"Go ahead," said the officer. "That's a new one on me."

—Pittsburgh Dispatch.

OH! I BEG YOUR PARDON

THE AEROPLANE IN AFRICA

Giraffe: "Here you, be careful where you're going. The next time you hit me in the neck I'll bite you."

He Knew

Deacon—Do you know anything about parts?

Choir Leader (*formerly automobile mechanic*) Sure. The soprano needs a new valve and the bass ought to have his exhaust fixed.—*Judge.*

Sentry Story No. 198,700

As in every other sentry story, the new recruit was doing guard duty for the first time. In the wee, sma' hours, there was a rattling that might have come from machine gun bullets but really came from milk cans (because this happened on Long Island). The milkman drove by.

"Halt!" yelled the sentry.

"Who's there?" inquired the milkman.

"Why—why—that's what I got to say," retorted the guard agitatedly.

Up to Him.

He: "Are you a widow?"

She: "Yes."

He: "My, but you have beautiful eyes!"

She: "If you don't stop your flirtation, when I get to heaven I'll tell my husband."

He: "Suppose he isn't there?"

She: "Then you tell him."

A certain private was called before Capt. Wright, Summary Court Officer, charged with a minor offense.

"Have you ever been tried before?" gruffly asked the S. C. O.

"Yes, sir."

"What was the nature of your offense?"

"Well, sir, I don't think there was any offense, but there was a new Summary Court Officer and I think the C. O. wanted to give him some practice."—*Fly Leaf.*

She Knew

Violet: "You have been making love to some other girl!"

Red Davis: "How do you know?"

Violet: "Because you have improved so."

Grand Finale

Two dusky soldiers, who had learned the manly art in the A.E.F., were putting on a farewell bout at the demobilization camp. As they advanced to the center for the preliminary handshake, one said:

"Yo' bettah git ready fo' de mawnin', man, 'cause when dey blows reveille yo' ain't gwine be round fo' breakfast."

"Huh!" retorted the other scornfully. "Dey is gwine play reveille all right, but yo' ain't gwine hear it. De las' moosic yo' hears is de taps Ah's gwine serenade yo' with."

—American Legion Weekly.

The Doctor: And if he loses consciousness again, give him a teaspoonful of that brandy.

The Patient's Wife: While he's unconscious? Sure, Doctor, he'd never forgive me.—*Life.*

An Exception to the Rule

Hokus: A man never gets anywhere by just letting things slide.

Pokus: How about the trombone player?

Mack—What's funnier than a one-armed man trying to wind his wrist watch?

Knutt—A glass eye at a keyhole.—*Lehigh Burr.*

First Gob: "Go much to the theater?"

Second Gob: "Considerably."

First Gob: "Ever see 'Oliver Twist'?"

Second Gob: "No; but I have seen Fatima wiggle."

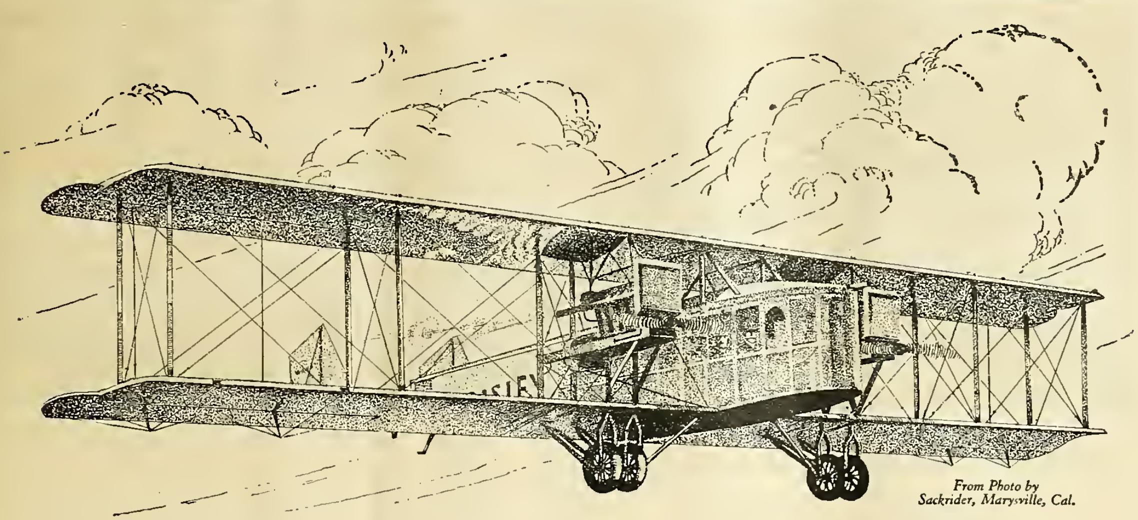
Sure to Miss

The scion of the family had acted so badly that punishment of some sort was necessary.

"Ernest," commanded his mother, "find a switch and bring it to me."

Shortly afterwards the bright young man returned.

"I couldn't find a switch, mamma," he reported, "but here's a stone you can throw at me."—*American Legion Weekly.*



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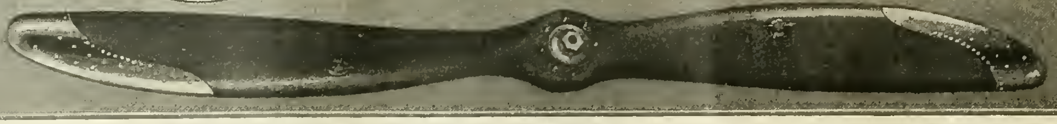

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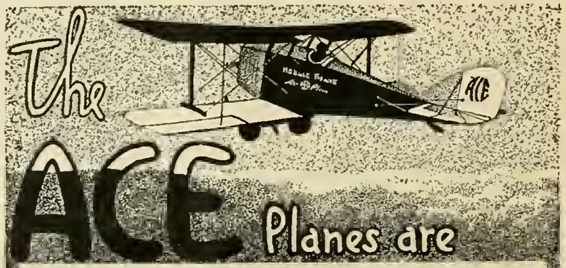

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TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

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Wicker Pilot Seats, $4.00 each, $36.00 per Doz.

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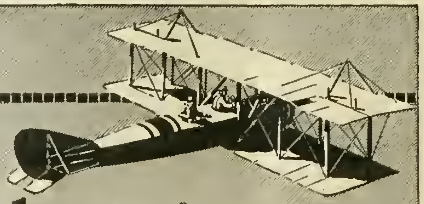

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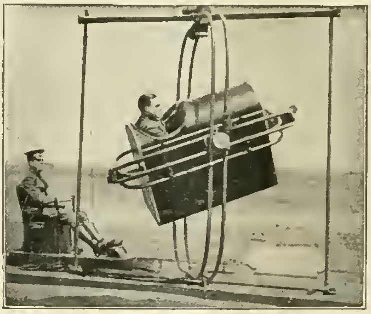

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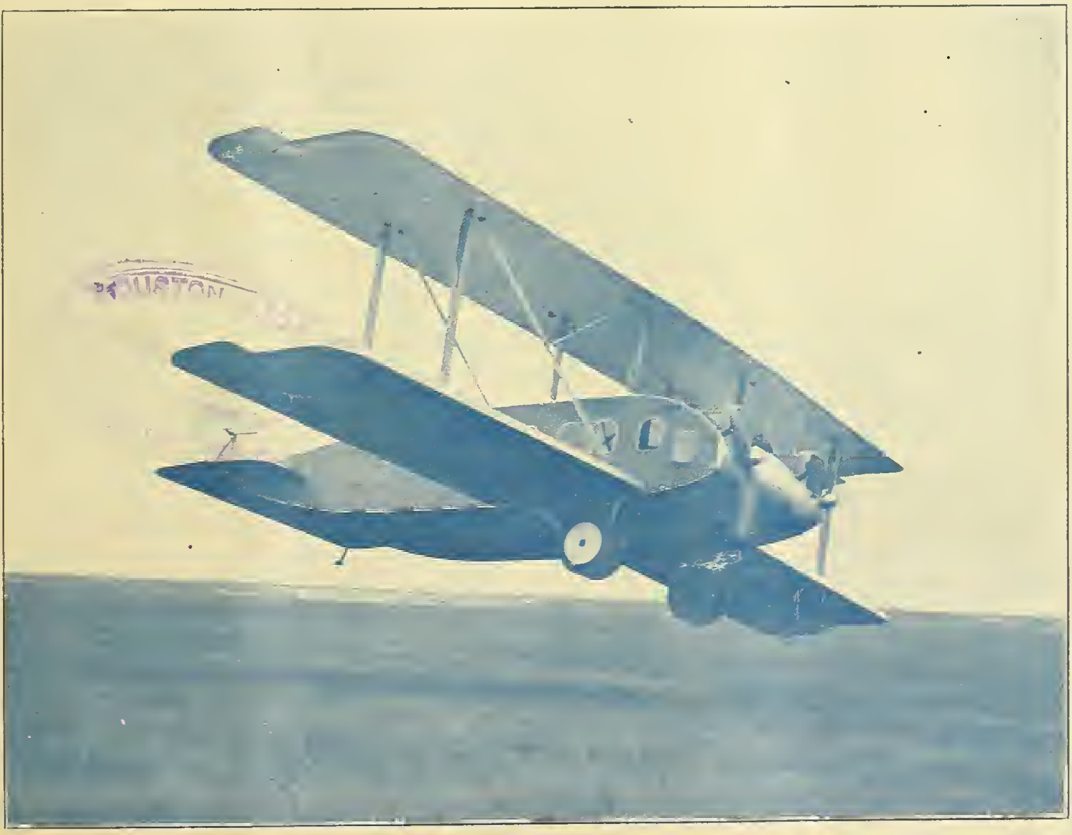
WEEKLY

VOL. 13, No. 22 AUGUST 8, 1921 10 CENTS A COPY



The Remington-Burnelli 30-Passenger Airliner Making a Landing

Delay of City Authorities Causes Rockaway Station Abandonment

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

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AERIAL AGE WEEKLY, 280 Madison Ave., New York City

AUGUST 8, 1921

AERIAL AGE WEEKLY

VOL. XIII, No. 22

TABLE OF CONTENTS

Delay of City Authorities Causes Rockaway Station Abandonment. 511
The News of the Week........... 512
The Aircraft Trade Review....... 514
The K L Fuel System............. 515
Experimental Night Flying by Flight Test Section, McCook Field 516
The Variation of Aerofoil Lift and Drag Co-efficients with Changes in Size and Speed.............. 518
Operating Tests of Magnetically Operated Starting Switches...... 521
Foreign Technical Digest.......... 522
Naval and Military Aeronautics.... 523
Foreign News 524
Elementary Aeronautics and Model Notes 525
Aeronitis 526

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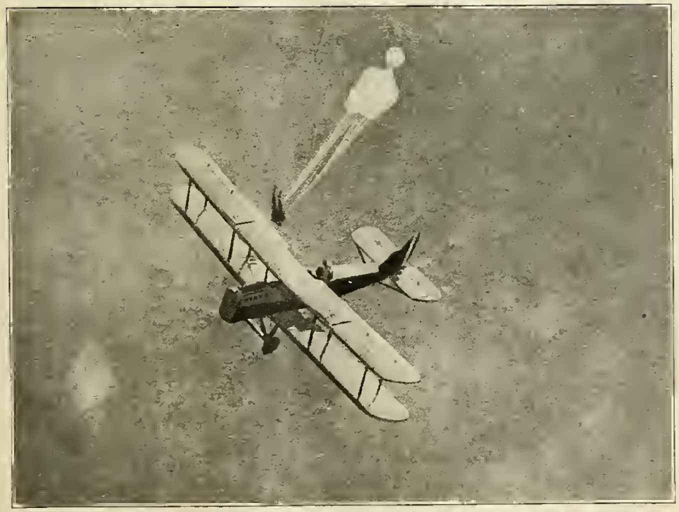

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VOL. XIII NEW YORK, AUGUST 8, 1921. NO. 22

Delay of City Authorities Causes Rockaway Station Abandonment

AFTER New York City's Sinking Fund Commission had repeatedly postponed action on the request of the Navy Department that about forty acres in Jacob Riis Park be ceded as a permanent site for the Rockaway Air Station, Secretary of Navy Denby directed the commanding officers at the station to prepare to cease activities there on September 1. Final action on the proposal for a permanent site at Rockaway Beach had been postponed to November by the Sinking Fund Commission.

The closing of the Rockaway Air Station leaves the entire Atlantic Coast north of Hampton Roads without an air station, the posts at Chatham, Mass., and Cape May, N. J., already having been closed by order of the Department. Naval officers had told the Sinking Fund Commission that the Rockaway site was the best strategic site for the protection of the city and urged that the city enable the Navy Department to build a permanent station.

The order received by Commander D. E. Cummings, commandant of the station, was signed by the Secretary of the Navy, and read as follows:

"It is purposed to place the air station under your command on a non-operative basis as soon after September 1 as practicable, pending final decision by the department. Stop operations except for tests. Order no material necessary after September 1. Make plans and preparations for the disposition of material, extend money allotted as far as practicable in closing up station."

The thirty officers and 250 enlisted men at the Air Station will be assigned to other stations, or to other duties in the navy, and by Winter the Air Station will be deserted. The ten seaplanes and the two blimps and other aircraft at the station will be flown to other posts, in accordance with future orders from the Navy Department, and all the hangars and barracks will be closed up, with only a few men on duty to guard against fire and theft.

During the war the Rockaway Air Station was one of the largest of the temporary air stations and was not merely used as a patrol base, but also as a repair yard for craft with the Atlantic fleet and for the testing of new planes and balloons. Its machines patrolled the entire New York Harbor and all along the coast and Long Island Sound from Cape May to Montauk Point. A pilot taking to the air at this station was able to watch vessels passing to and from the ocean without going out of sight of his own hangars.

Here the historic NC transatlantic expedition tuned up its planes for the hop across the sea, and the planes took off at the Rockaway runways for their first leap to Halifax. This was also the home station of the free balloon that carried Lieutenants Walter Hinton, Stephen Farrell and A. L. Kloor into the Canadian wilderness. The C-5 also started from this station on its unsuccessful transatlantic attempt and was blown to sea at St. Johns.

Only one other station had hangars large enough for the NC planes. The Rockaway Air Station has two of these large hangars, with smaller hangars for the other seaplanes and a big hangar for lighter-than-air craft. It has wooden barracks for about 300 men and fifty officers, all of temporary construction.

The site of forty acres during the war accommodated as high as 800 officers and men and eighty planes, and pilots who had finished their training there were assigned to other stations.

During the last year many important tests of aircraft have been carried on at the station with the D-6, the largest dirigible, as well as with lighter-than-air craft built so that they could be towed at sea by destroyers or mother ships. Much material also has been stored at Rockaway.

Officers at the station had reports several days ago that they would be transferred soon, and that the station probably would be closed, and some of them expressed the unofficial opinion that the failure of the city to cede the site might have had something to do with the navy's plans. Some of these officers have pointed out to the city the strategic value of the site.

THE NEWS OF THE WEEK

Denby Wants 30 Million For Plane Carriers

Washington.—Recommendation that approximately $30,000,000 be appropriated for construction of two aeroplane carriers will be made to Congress in the near future, Secretary of the Navy Denby announced July 25. A measure embodying such a proposal is pending before the House Naval Committee, and it is understood that the Naval Secretary will urge its speedy enactment.

Coincident with Mr. Denby's announcement, Senator King, Democrat, Utah, introduced a bill which would provide for conversion of the battle cruisers Saratoga, Lexington and Constellation into aeroplane carriers, and for stoppage of construction work on the battleships South Dakota, Indiana, Montana, North Carolina, Iowa and Massachusetts and on the battle-cruisers Ranger, Constitution and United States.

Secretary Denby said he had decided on his forthcoming recommendation even before the recent bombing tests, but that the results of those tests had convinced him that the navy needed more aeroplane carriers. Senator King, addressing the Senate in behalf of his bill, said that the bombing tests had demonstrated conclusively that "too much importance" had been attached to capital ships and too little attention devoted to aircraft and submarines.

Secretary Denby indicated that in his opinion it would be wise to construct two new aeroplane carriers, one for the Atlantic fleet and the other for the Pacific forces. Two carriers were provided for in the current naval appropriation bill as it passed the Senate, but the House refused to accept the provision and it was stricken out.

The Los Angeles Tournament

At the International Air Tournament held at the Los Angeles Speedway July 16th and 17th, the feature event of the meet was the Curtiss Cup Race which was open to planes equipped with a Curtiss OX-5 motor which passed an elimination speed test of 100 miles per hour. This race was won by the Pacific Standard Model Cl.

This plane was specifically designed by O. W. Timm and built in the factory of the Pacific Airplane & Supply Company and attained a maximum speed of 137½ miles per hour in its elimination tests and averaged 105⅖ miles per hour in the race, which was held over a hair pin turn course, around pylons situated 1 mile apart.

In the construction of this plane the elimination of head resistance was the prime factor. In every possible way resistance was overcome. A modified U. S. A. 27 wing curve was used, making it possible to eliminate all external braces, struts and wires. The fuselage is made entirely of laminated wood, highly finished and perfectly streamlined.

The Pacific Standard Model Cl was built by the Pacific Airplane & Supply Company as an experimental job for commercial racing and to bring before the Government a new type of scout training plane. Emery H. Rogers, President of the Pacific Airplane & Supply Company, piloted the plane in the Curtiss Cup Race, and emphatically states that in his entire experience he has never handled a machine which was so easy on the controls and so quick to respond to the control action.

Nelson Meet a Big Success

The Nelson, Nebraska, Aviation Meet which closed July 16th, proved to be one of the biggest and best Aero Meets in that section of the country. The meet drew approximately 25,000 people the three days. Pilots Smith, Cochran, Weaver, Beach, Wagner and Friday were winners and carried home cups. DeForest Swanson, manager of the Central Aircraft Company, and who had charge of the Holdrege Meet last May, had charge of the meet.

Brief News Notes

A Commercial Aero Exposition is to be held in the City of Mexico, in September.

The Aero Club of America is planning to have flying activities at Hazelhurst Field in the near future.

The Aero Club of America has started out on a National Campaign for Membership for the support of Aeronautics.

New York City "Wiped Out" in Big War Game

New York was totally destroyed and eliminated as a military factor July 30, theoretically speaking, when an "enemy" bombing fleet comprising one Handley Page, one Caproni and fifteen Martin aeroplanes, under the direction of Brig. Gen. William Mitchell, Assistant Chief of Air Service, dropped twenty-one tons of gas, flame and fragmentation bombs over the lower city in two raids. Although General Mitchell refused to be quoted, an officer of high rank said that the air service had successfully demonstrated the defenselessness of New York and other Atlantic seaboard cities.

The attack was part of a tactical problem which the air service had been working out since the sinking of the Ostfriesland last week. In this case, the flyers were turned into an enemy raiding force with orders to pave the way for the landing of a hostile army from overseas.

The theoretical situation leading up to the capture of New York was as follows: War had been declared by a foreign power on July 15. Six days later two hostile forces engaged with each other at a point seventy-five miles east of the mouth of Chesapeake Bay. The only aircraft with our navy were a few seaplanes and unarmed training planes, which were quickly shot down by a greater number of enemy aircraft. The Red air force followed with an attack on the entire Blue (United States) fleet, ending in the sinking of the last of our battleships on the Atlantic coast.

On July 22 the Red air raiding force landed from the carriers and established an air base at a point eight miles north of Cape Hatteras. Operating from their airdrome, the aviators in night attacks destroyed our planes centred at Langley Field, Va., and the Norfolk Navy Yard. This sustained the position of the enemy as far as interference by land and sea was concerned, and enabled them to be within striking distance of the remaining air stations at Bolling Field, outside of Washington, and Mitchel Field, near Garden City, L. I. On the 24th Richmond, Va., was destroyed, and in succeeding attacks Newport News and Norfolk.

The commander of the enemy forces then ordered the attack on New York. The squadron, led by the giant Caproni, and with a crew of about seventy men, distributed among the raiding planes, swung over lower Manhattan in the first attack shortly before noon. Flying at an average height of 8,000 feet, plane after plane released the theoretical 1,100 and 2,000-pound fragmentation bombs, as well as those of the flame and gas variety. The effect of the gas bombs was felt as far at Times Square, according to the air officers, and those of the inhabitants who survived their deadly effect were scurrying towards Yonkers.

Returning from the second attack, the planes flew at a close range, and the raiders picked out such buildings as the Woolworth Building, the Sub-Treasury and the Custom House as their especial targets. The planes hovered at 5,000 feet.

The destruction of the lower city having been completed and the inhabitants either killed or fleeing, the Reds turned their attention to the elimination of the Brooklyn Navy Yard, following which they flew to Mitchel Field. Last night the pilots and enlisted men were given leave until Monday to visit the city they had "destroyed." The Reds also were to have attacked Philadelphia, but deferred the destruction of that city until next week.

The flyers said that ideal weather conditions obtained. Low visibility at the height at which the attacking air force flew would have made the planes difficult targets for anti-aircraft batteries. On the other hand, the raiders had little trouble in picking out their targets, the aviators said.

The force under General Mitchell was divided into two heavy bombing squadrons commanded by Major Leo Walton and Major T. J. Hanley. There also was a pursuit group under Captain B. B. Baueus. A Thomas Morse scout plane, which proceeded the bombers at one stage of the flight, attained a speed of 170 miles an hour.

Advocates of a bigger air force cited the "attack" as vividly illustrating what might take place should an enemy force eliminate our air forces. If seventy men in only seventeen planes could do all this, much greater damage and destruction would result from a larger force, they pointed out. The pertinence of the attack on New York in view of the recently announced abandonment of the Rockaway Point Air Station also was pointed out.

New Rules Prohibit Army "Stunt" Flying

Washington.—Aroused by the fatal accidents occurring as the result of aeroplanes doing "stunts" over holiday crowds, the War Department has issued general orders restricting flying over towns and prohibiting "stunt flying" over crowds except under unusual conditions. Practically the same general rules apply to lighter-than-air craft.

Except in taking off from fields located in or near thickly populated areas, the general order provides that planes will be so flown that the line of flight and altitude will be such as to permit them to glide with a dead motor to a safe landing without danger to persons or property on the ground.

The paragraph dealing with "stunt flying" in the general order reads:

"Acrobatic flying over cities, towns or populous districts or over assemblages of persons gathered on the borders of flying fields to witness demonstrations is forbidden."

It is provided, however, that these restrictions may be departed from when the mission prescribed by proper authority requires low altitude flying, in which case special precautions must be taken to see that the plane functions properly.

Free balloons are prohibited from flying over populous localities with a drag rope loose, and "drag-roping" is permitted only for training or emergency purposes and then only over open country. The use of balloon anchors over populous areas is absolutely prohibited, their use being restricted to forced landings, inclement weather conditions and for training purposes.

The following rules are laid down for flying over assemblages of people, including people gathered on foot and in vehicles around the borders of flying demonstrations:

1. Flying prohibited below an altitude of 1,000 feet, except in taking off. Plane must be flown in a position from which glide with dead motor can be made to safety.

2. Strict inspection of every part of plane at least one minute immediately before taking the air for each flight.

3. Before taking off and before landing, pilots must assure themselves that landing field is clear.

While the new orders apply only to army fliers, it is expected that some such rules will also be adopted by other branches of the Government maintaining air activities.

Plan to Keep World Informed on ZR-2's Transatlantic Trip

London.—Lieutenant Clifford A. Tinker, U. S. N., has arrived here and is arranging with the Air Ministry the plans to keep the United States and Great Britain informed of the experiences of the big dirigible airship ZR-2, formerly the R-38, which has been purchased by the United States Navy from Great Britain, during its flight to America.

The start of the flight is expected to take place in the middle of September.

Many aviators, magazine writers and other persons have sought permission to take part in the voyage across the Atlantic, but Secretary of the Navy Denby has cabled that no correspondent or any "non-military" passengers will be permitted on the trip.

Aviator Lands on Mont Blanc

Paris.—A French aviator has accomplished the difficult feat of landing on the top of Mont Blanc and flying away again.

On July 30 at 6:15 o'clock Lieutenant Durefour of the French army started from a field near Lausanne and at 7:05 landed on top of the peak at a height of 15,782 feet.

He got out of his machine, walked around for ten minutes, then took to the air again. Twenty minutes later he landed safely near Chamounix.

Flier Saved by Nerve When Wing Collapses

Several hundred persons, including Brig.-Gen. William Mitchell and other officers, were thrilled at Mitchel Field July 30, when Lieut. A. O. Doolittle by skilful manœuvring saved himself from what appeared to be certain death.

Lieut. Doolittle was flying a fast scout plane. While coming out of a loop about 300 feet from the ground, he discovered the trailing heads of the plane had collapsed, causing it to wabble. Then one wing collapsed. He was unable to turn the plane, but he remained cool and managed to land on an even keel in soft dirt. The plane was wrecked, but Lieut. Doolittle escaped injury. He immediately made another flight in a machine of the same type.

Line Officers Must Be Prepared on Aviation

In view of the realization of the important part aircraft operations are destined to assume in naval warfare of the future, it is planned to require that all officers of the line of the Navy, besides those that make a specialty of aviation, shall have a good working knowledge of aeronautics.

As a step in this direction, an order is about to be issued by the Navy Department requiring all the officers after January 1 next, to be prepared, on professional examinations, for promotion up to the grade of lieutenant commander, to answer questions on aeronautics, questions to be included in the examination now are being prepared in the aviation section of the officer of the chief of naval operations.

Midshipmen at the Naval Academy are being given elemental instruction in aircraft engineering and operation, and it is planned during the next term to extend the curriculum in that particular. The academy at present is equipped in its engineering department with various types of aircraft motors and two aeroplanes are stationed there, where the equipment is available particularly to those assigned to post-graduate instruction in aeronautics, as well as to the midshipmen.

Officers regularly are being assigned to the Naval Air Station at Pensacola, Fla., for six months' primary course in aeronautics. The course includes ground instruction in aircraft construction and engineering, navigation and tactics and flight training for qualification as pilots and observers and for proficiency in bombs, torpedoes, etc., and some officers also are trained in lighter-than-air craft. Following that course, selected officers are assigned to post-graduate instruction in aeronautical engineering, which includes one term at the Naval Academy and another year at Massachusetts Institute of Technology.

To Attempt Polar Flight

Washington.—Plans for a trans-polar flight in September from Point Barrow, Alaska, to Spitzbergen and the North Cape, Norway, were announced August 1 by Edwin Fairfax Naulty, of New York. Scientific observation of ocean, air and ice currents will be the chief purpose of the trip, Mr. Naulty said, with the hope of establishing the feasibility of a new route for commerce as a secondary consideration. The distance is approximately 2,500 miles.

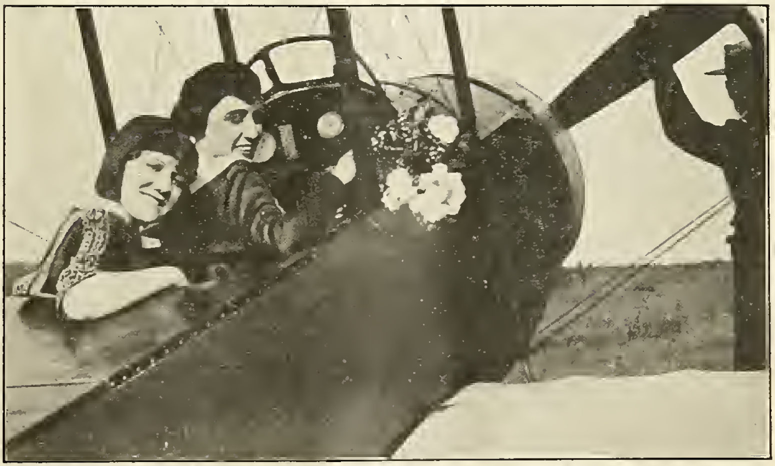
As announced, the start will be made from Seattle with a convoy of several planes, which will proceed by easy stages up the Alaskan coast to Point Barrow, stopping at Ketchikan, Anchorage and Nome. The Arctic flight will be made by one plane, which already has been constructed, carrying four men, including Mr. Naulty. The other three are former service men. It was said their names would be announced soon.

Originally, it was explained, it was the intention to make the flight next year, but reports of warm weather near the Arctic Circle had led to the advancing of the date.

"We plan to make the flight as early as possible," Mr. Naulty said, "and, strange as it may seem, to do it in late September. There are good reasons for the choice of this time. Our flight speed we estimate will be about 100 miles an hour, to which might be added the speed of a following air current."

Fuel was conceded to be the chief problem. A supply ample for fifty hours of continuous flight will be carried, it was said, and those planning the attempt expressed the belief that this would furnish an excess which would permit short by-flights at the first landing place on the polar ice and at the Pole itself.

If the first flight is successful others will be undertaken at once.



The Sport-Farman finds much favor amongst women flyers. The picture shows Mrs. H. R. Tucker, of Fairmont, West Virginia, initiating a girl friend to the pleasures of flying. She is the wife of Harrison R. Tucker, of the Southern Airplane Co. Farnham distributors, and has made a number of long cross-country flights with her husband

The AIRCRAFT TRADE REVIEW

The Cox-Klemin Aircraft Corps Organized

Capt. Charles Cox and Alexander Klemin have established a fully equipped plant at College Point, L. I., for the construction of aircraft.

The concern will be known as the Cox-Klemin Aircraft Corporation, and will undertake the design and construction of special aeroplanes for every purpose.

The company has taken over the engineering organization of Alexander Klemin and Associates, and has started construction on an order of five six-passenger twin engine monoplanes, an amphibious design for a Pennsylvania capitalist.

Capt. Cox, the President and General Manager, is a capable business man, and experienced pilot.

Alexander Klemin, Vice-President and Chief Engineer, is considered an authority on aeronautics in this country, and for the past two years has been Consulting Engineer to aeroplane companies and the Government.

The factory manager is Mr. Frank W. La Vista, who, for the past six years, has been associated with the L. W. F. Company. Mr. La Vista is a capable constructor, and, no doubt, will be very successful in his new position.

Conference Against British Air Service

London.—One of the matters discussed by the Imperial Conference in London has been the possibility of using airships as a method of improving communications between the mother country and the far-flung Dominions of the British Empire. A committee was appointed to report on the subject, and its unanimous decision is that any scheme of the kind would be too costly.

The Dominion Premiers and the British Government have to decide whether they will go shares in maintaining British airships and their personnel as the nucleus of a great imperial trans-oceanic air service. The committee estimated that it would require an expenditure of £10,000,000 to run an airship service for five or six years, and it came to the conclusion that from the commercial point of view the experiment would not be worth the expense, especially when the present financial situation was considered.

Manufacturers Aircraft Association Elects Officers

J. K. Robinson, Jr., president of the Gallaudet Aircraft Corporation, East Greenwich, R. I., was elected president of the Manufacturers Aircraft Association, Inc., at the annual meeting of the Association, 501 Fifth Avenue, New York City, July 28. G. M. Williams, general manager of the Dayton Wright Company, Dayton, Ohio, was elected vice-president; F. H. Russell, vice-president of the Curtiss Aeroplane and Motor Corporation, Garden City, N. Y., secretary, and F. B. Rentschler, president of the Wright Aeronautical Corporation, Paterson, N. J., treasurer. In addition to these, there were elected to the Board of Directors the following: A. H. Flint, L. W. F. Engineering Co., College Point, N. Y.; I. M. Uppercu, Aeromarine Plane and Motor Co., Keyport, N. J.; Glenn L. Martin, Glenn L. Martin Co., Cleveland, O.; F. L. Morse, Thomas-Morse Aircraft Corp., Ithaca, N. Y.; and Col. J. G. Vincent, Packard Motor Car Co., Detroit, Mich. S. C. Bradley was reelected general manager and assistant treasurer.

Rickenbacker Organizes Auto Co.

Detroit, July 30.—Captain Edward V. Rickenbacker, world famous as America's ace of aces during the war and before the conflict with Germany one of the foremost race drivers in the United States, has entered the automobile manufacturing field in association with B. F. Everitt and Walter E. Flanders. The announcement has caused much comment in the motor car industry.

The Rickenbacker Motor Company is the name of the new corporation, which is capitalized at $5,000,000. The officers of the organization will be: President and general manager, B. F. Everitt; vice-president and director of sales, Edward V. Rickenbacker; secretary and treasurer, Harry L. Cunningham; board of directors, B. F. Everitt, Walter E. Flanders, Edward V. Rickenbacker, Harry L. Cunningham, Carl Tichenor, Roy Hood and E. R. Evans.

The Rickenbacker car is to be made in Detroit.

Inquiry Will Disclose Engine Ideals

WASHINGTON.—Information of great value in designing aeroplane engines in the United States is promised by the Bureau of Standards in forthcoming final reports to be made in connection with a thorough investigation that has been completed as to the performance of two well-known makes of German Aeroplanes. The investigation was made through co-operation between the Bureau and the Air Service at McCook Field.

The two engines which have been investigated are known as the B. M. W., 185 hp., and the Maybach, 300 hp. Both machines are of the 6-cylinder type which has long been a favorite in Germany.

It may be of interest to note, the Bureau reports, that the performance of the B. M. W. engine at high altitude was excellent, its low fuel consumption being the outstanding feature of merit. The chief point of interest in connection with the Maybach was the design of the carburetor, which, however, cannot be considered as entirely satisfactory as, although it gave excellent economy of fuel, the efficiency of the engine at part load was rather poor.

Kansas Aviation Meet

An Aero Meet and Show will be held at Concordia, Kans., on August 11, 12 and 13 and already twenty pilots have indicated their intention of competing in the various events.

Free gas, oil and hotel accommodations are to be supplied to participating pilots and a banquet for all of the contestants will be a feature of the closing night.

Lund with Pioneer Instrument Co.

Nels B. Lund has joined the Pioneer Instrument Company as assistant to Chief Engineer M. M. Titterington.

Mr. Lund is a pioneer in the design of aircraft instruments and gyroscopic apparatus, having been associated with the Aircraft Instrument Department of the Sperry Gyroscope Company in 1917, 1918 and 1919. He has also had a broad experience in the design of delicate instruments and special apparatus of many kinds.

The assistance of Mr. Lund in the Engineering Department will permit Mr. Titterington to devote a larger part of his time to experimental and development work.

Washington Aero Engineers to Open New York Office

New York.—An agreement has just been effected between the firms of A. & D. R. Black, Washington, D. C., and Alexander Klemin and Associates, New York, by which the former will take over the offices at 22 East 17th Street, New York, to be vacated by the latter firm upon removal of its staff to the plant of the Cox-Klemin Aircraft Corporation, College Point, N. Y.

On account of the taking over of Mr. Klemin's organization by the Cox-Klemin Corporation certain classes of inquiries (particularly in the consulting field) which he will no longer be in a position to handle will be referred to A. & D. R. Black.

As a part of these changes the Black firm will remove its head office from Washington to 22 East 17th street, New York, on August 15th. Its present office in the Evening Star Building, Washington, will be continued as a Washington branch.

Aerial Patrol of Sea Lanes

Acting Secretary of the Navy Roosevelt has asked the House Committee on Naval Affairs to include in the Legislative Naval bill for 1921 a proviso "that naval aviation shall have cognizance of the aerial operations necessary to gain and exercise command of the sea and of such stations and craft as are necessary to insure adequate aerial patrol of the sea lanes for these purposes." Under existing law dividing aerial responsibility between the two Services, the Navy is not charged with keeping open the sea lanes for coastal shipping. This, says Mr. Roosevelt, "is an integral part of the Navy's duty and was the major work it performed in aviation during the late war. The Navy's development of aircraft is toward types that can perform this duty. In war time the Navy will have to and should do this work and the army will not have suitable planes for it, and, moreover, the Army will be occupied on its legitimate function, the land defense. It is extremely desirable as a matter of national policy that Congress fix responsibility by law for the defense of the United States in conformity with the approved plans of the War and Navy Departments as promulgated by the Joint Board."

THE K L FUEL SYSTEM

THE fuel system described herewith was designed to overcome the troublesome features which have been common to most of the complex systems now in use and to completely meet the exacting requirements of aeroplane work. A study of the design would indicate that these most desirable qualities have been well attained.

The designers have had many years' experience with the various systems and have stated the essential requirements of any fuel system to be:

1. A positive method of supplying fuel to the carburetor before the engine is started.
2. After the engine is started, an ample supply of fuel at the carburetor, under practically constant pressure, and under all possible conditions of engine loading and flight positions of the plane.
3. Fuel must be clean.
4. System must be arranged to take fuel from two or more tanks. Sufficient tank capacity for any reasonable length of flight is usually in two or more tanks in present type ships.
5. The system should be able to operate correctly, no matter what the relative location of the fuel tanks and the parts of the system.
6. The piping, connections and fittings must be an absolute minimum and the whole pipe system should be as near trouble and leak-proof as is possible.
7. It is also desirable to have as little piping and as few pipe joints *under pressure* as is possible.

The solution of this important problem has resulted in the admirable design described below, which is worthy of most careful consideration.

The whole system between the fuel tanks and the carburetor consists of but two major parts, viz: a hand pump and an engine-driven pump; with the connecting piping and strainer. A brief description of these two pumps will make the operation of the system apparent.

Engine-Driven Pump. A gear-type main fuel pump is arranged to be driven by the engine, Fig. 1, a practice now acknowledged to be the best, and thus the pump capacity is nearly in proportion to the fuel consumption. The capacity is, however, always in excess of the demand. All excess fuel delivered is lead from the discharge to the inlet side of the pump through a spring-loaded safety valve and passage contained in the pump body. The spring tension may be adjusted by an outside wheel and the discharge pressure regulated as desired. Such a return or relief system is usually made up of outside piping, but putting this in the pump body eliminates all outside piping and connections and so eliminates this source of leakage.

To provide a line for fuel delivered from the hand pump a passage is machined in the cover plate of the power pump and provided with a check valve preventing flow in the opposite direction. By this construction, another line of outside pipe common to some systems is eliminated.

Since reliability is the prime essential, all working parts are purposely made with a factor of safety greater than any part of the engine or plane.

This, together with the use of the best obtainable materials and the highest quality of workmanship are relied upon to make this unit the most reliable element of the entire power plant. The body is of "non-gran" bronze and the gears are of chrome nickel steel. The gears are cut with a special form of tooth so that a free-running long-life pump is the very desirable product.

The view in Fig. 1 shows the pump mounted in a bracket carrying a spiral gear drive arranged for direct attachment to a Liberty-12 Engine. The smaller connection opposite the pressure adjusting wheel is for a tube to the pressure gauge mounted upon the instrument board.

Ample stuffing boxes are provided around both the driving shaft and the spring-adjusting stem, but any leakage

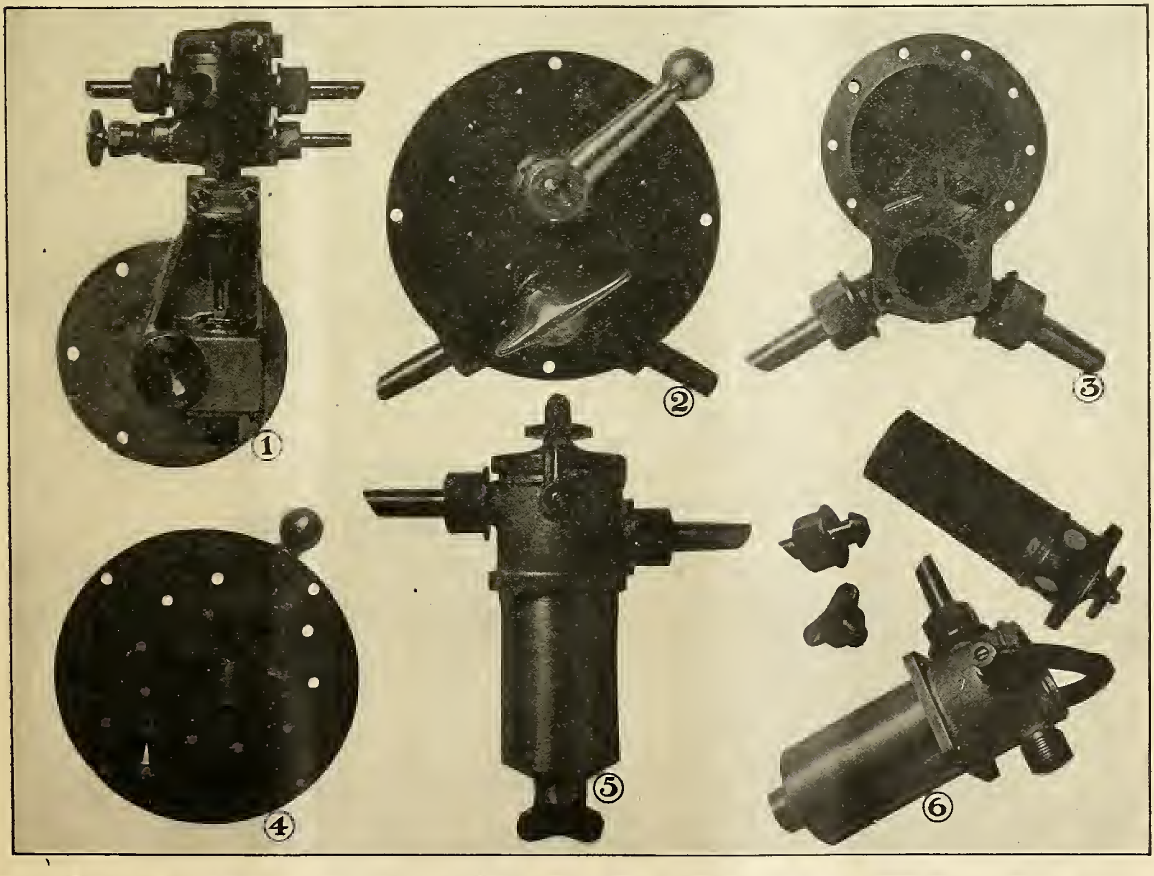


Fig. 1—Power Pump with drive and support for Liberty Engine. Fig. 2—Front of Hand Pump. Fig. 3—Exterior of hand pump showing inlet valves. Fig. 4—Cover and motor of hand pump. Fig. 5—Exterior of strainer. Fig. 6—Parts of strainer

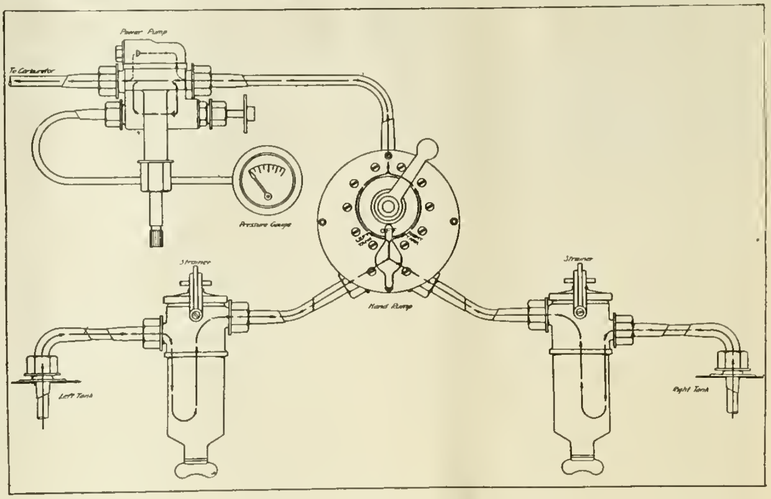


Diagram of the K. L. Fuel System

along the driving shaft is drawn back to the suction side of the pump through a hole drilled from the clearance space around the shaft to the inlet passage and any leakage around the adjusting stem consists of air into the system rather than fuel out.

Hand Pump. This pump is of the so-called "wobble" or oscillating type, so successfully used abroad during the war and since. Figs. 2, 3, 4 and 5 show essential features of construction. Fuel enters through the two connections shown and passes through the combination two-way and shut-off valve, the extreme positions of which connect either tank and the mid position of which shuts off both lines entirely.

The plain suction valves in the lower valve plate, Fig. 4, and the discharge valves in the oscillating plate, Fig. 5, permit fuel to pass freely through the pump when it is not in action as a pump and thus makes it, at such time, a part of the fuel flow line.

On the back of the pump is a fuel return passage leading fuel from the discharge to the suction side through a spring loaded safety valve. This makes it impossible, by a too vigorous operation, to build up excessive pressure which might damage the pressure gauge or flood the carburetor in starting or in running.

Lock Unions. Every pipe connection in the entire system is a special extra-heavy ground-joint union locked in place, when made up, by a spring washer between the nut and shoulder on the male end. Provision for lock wires is also made and if further insurance against leakage is desired, all connections may be surrounded by rubber couplings. While provision has been made, in the past, for locking about all the fastenings of an aeroplane, it is believed that such important fastenings as pipe unions have not heretofore been locked.

Strainers. Believing that the strainers now in use were susceptible of improvement, a new design is supplied in order to prevent possible trouble from this simple but important element of the system. Fig. 6 is an exterior view and Fig. 7 shows the principal parts.

The fine-mesh straining surface is ample and easily removed for cleaning by releasing the nut and bale at the top. The plug at the bottom permits accuumalted water or sediment to be easily drained. Both operations are accomplished without disconnecting any piping or disturbing the mounting. Locked spring-washer unions provide the pipe connections to this part as well as to all others.

The body is machined so that a strap support may be used, or the strainer may be supported on the square flange shown.

General Arrangement and Operation. The simplicity and mode of operation are illustrated in Fig. 8. It is seen that all parts of the system are in series, so to speak, and only a single line of pipe is used beyond the hand pump. The flow should be apparent from the drawing.

In starting, the hand pump is used to force fuel to the carburetor and incidentally prime the power pump. After the engine starts, the engine-driven gear pump furnishes fuel continuously, the pressure being automatically governed as previously described. The hand pump then becomes a part of the suction line. However, in case of failure of the power pump, the hand pump may be used continually to furnish fuel to the carburetor.

It should require but little thought to see that the system described fulfills, almost ideally, every requirement numerated at the start. Some very important features, which have been prolific sources of trouble in the past, are worth emphasizing. In the first place, the number of pipe connections and the amount of piping are reduced to an irreducible minimum. Secondly in the normal operation, there is no pressure on any part of the system, except the line running from the discharge of the power pump to the carburetor and to the pressure gauge and these short lines can be properly protected from leakage. The tendency on other parts of the system is for air leaks into rather than fuel leaks out. Third, the operation should be equally good and reliable, no matter what the relative elevations and locations of the main fuel tanks, parts of the system and the engine, thus permitting fuel tanks and other parts to be located where most convenient.

The power pump, the delivery line under pressure and the carburetor, by proper mounting, are integral parts of the engine and are thus free from liability to failure due to relative motion between the engine and plane as is common in most other systems.

While the power pump mounting and drive illustrated is for use on a Liberty Engine, suitable mounting and drive arrangements are being developed for use with all other standard aviation engines.

The entire system is being manufactured and sold by the K. L. Automotive Specialties Company, New York City.

EXPERIMENTAL NIGHT FLYING BY FLIGHT TEST SECTION, McCOOK FIELD

By LIEUT. MUIR S. FAIRCHILD

ON the nights of February 24 and 25, and May 27, a number of test flights were made at McCook Field, Dayton, Ohio. The purpose of these flights was to determine the effectiveness of various devices for landing, and the efficiency of lighting arrangements in the cockpit, and to study other phases of night flying, such as the problem of exhausts and the reflection of light from propellers. Among the aeroplanes used were the JN-4H, the USXB-1 and the Glenn Martin Bomber.

Electric Landing Lights

In regard to the electric landing lights tested, it is believed that the type fitted with glass with vertical ribs was slightly more satisfactory than the type with horizontal ribs, owing to the fact that the former did not diffuse the light so much as the latter, and hence the blinding effect was not so great, particularly with respect to the propeller, which becomes a disk impossible to see through when light gets on it. In the May tests, a cherry red propeller was used on one of the aeroplanes with such satisfactory results as regards light reflection, that it would be well to finish all propellers on night-flying aeroplanes in this way.

However, neither of these lights could be considered very satisfactory, especially in view of their very large size and high power. It is thought that a more satisfactory result would be obtained with lights in which the beams were concentrated on a point on the ground some little distance in advance of the plane and which were fitted with some sort of side plates or blinders to keep the rays out of the propeller. The average pilot in landing a ship does not look at the ground immediately in front of the plane, but fixes his gaze on a spot some distance ahead, say from 50 to 75 feet. This is the spot which needs illumination and the illumination of the ground immediately in front of the plane and to the sides is neither necessary nor desirable.

It is believed that comparatively small but high powered lights throwing a searchlight beam could be used to much greater advantage, and that these lights might be streamlined into the wing tips in the case of tractors or placed on the nose of pushers and bi-motored ships. When these could be made adjustable, vertically, from the pilot's seat, it would be an advantage to have them so, and where they could not easily be so made, they should be so adjusted as to throw the point of brightest illumination on each side at the approximate point a pilot would be looking at in the act of landing. The May tests showed that a 35 ampere bulb landing light gave very satisfactory results.

Wing Tip Flares

If magnesium flares are to be used, the greatest care is necessary in placing the control buttons of these flares in the cockpits of planes designed for service over the lines at night. It was noted particularly in the case of one aeroplane, equipped for night flying, that the flare buttons were so placed at the left of the cockpit that an incautious movement of the pilot's arm in the darkness might very readily set off a glare. At least one instance is known of a flare igniting over enemy territory which nearly resulted in the loss of the ship.

It would be extremely desirable to so perfect electric landing lights that they might be used to entirely replace flares. These flares are extremely dangerous devices and their functions could be performed much better and with far greater safety by electric landing lights. In using these flares on landing into a field with dry grass, the grass is inevitably ignited, resulting in the destruction of the plane by fire unless it can be quickly extinguished or the plane kept in motion in front of it. In the case of a forced landing at night, using the flares, which resulted in the slightest crash, the plane would almost certainly be burned and in the case of the crew being pinned in in any way, this would be a very grave danger. As the chances of a crash in forced landings at night are very great indeed, owing to the practical impossibility of seeing isolated obstacles by the light of flares, it is obvious that the magnesium flare is far from satisfactory and should be done away with as soon as possible.

Electric landing lights avoid all these difficulties and dangers, and are far more reliable than the flares. A flare cannot be tested without its destruction, and one never knows until it is needed whether or not it will light. If it is once lighted by accident over the lines there is nothing to do but let it burn out which is a very grave danger in the presence of anti-aircraft batteries or night pursuit. On the other hand, electric lights may be tested as often as desired and with the present standard of electric equipment may be considered to be as reliable as any device that could be constructed. Furthermore, they have the additional advantage that they are under the pilot's control at all times and may be turned off as well as on.

A further disadvantage of wing tip flares was developed. Fifty per cent of the number which passed the "continuity of circuit tests" started to burn and then went out because of deterioration of the active material. These tests showed that half of the flares which were passed for continuity of circuit, as explained in British Technical Orders, or as directed on the case of the flare, will not function.

For the foregoing reasons, it is recommended that steps be taken to perfect electric landing lights for standard equipment of all night flying ships and that magnesium flares be done away with as soon as this is accomplished.

Cockpit Lighting Arrangements

The difficulties of night flying over the lines are great enough under the best of conditions and everything possible should be done to make the crew's task as easy as possible. This applies especially to the arrangement of the cockpit and the instruments. This is a point which has not been sufficiently considered in the layout of some aeroplanes. With a bi-motored aeroplane, this becomes especially important. Certain instruments, for example oil pressure gages, are mounted on the engine nacelles. Other instruments, such as the gravity fuel tank overflow gages may be mounted outside the cockpit on the struts or nacelles. It is essential that the pilot be able to read these instruments without difficulty. For active service over the front, it is out of the question to use powerful flashlights to observe them. Making the dials of these instruments luminous by the use of luminous paint is not sufficient. Experiments should be carried out as to the practicability of inserting a small light under the glass of the instruments carried on the motor nacelles, and one behind the glass tubes of the overflow gages. These lights would be controlled by a push button in the cockpit and should be as dim as possible and still allow the instruments to be read. In commercial work, of course, no precautions have to be observed about showing lights, and the problem of lighting remote instruments is simplified.

Just as much care should be given to the arrangement of the instruments in the cockpit, and this applies with equal force to both military and commercial aeroplanes. Such an instrument as the air speed indicator, for instance, which is of vital importance to a pilot flying a heavily loaded plane on black nights, should be in plain view of the pilot and not behind the control column or wheel. Any instruments which depend for their visibility on luminous paint should be repainted as soon as they begin to become dim. Care should be taken in locating the compass so that it is not affected by the movement of any steel parts like the control column. The use of a Sperry compass of the Navy type would eliminate the errors due to the effect of the presence of iron or steel on a magnetic compass. On one of the aeroplanes tested, the shudder controls were located on the left side of the cockpit, the pilot's seat being on the right. As a result, they required great effort to operate and at the full extension of the pilot's arm sometimes could not be managed. It is essential in all aeroplanes with the side by side seating arrangement that these controls be so located that the pilot can operate them with a minimum of effort.

Luminous paint could be used to great advantage in many places where it is not used at present. For instance, it would be very desirable to have a dot of luminous paint on the altitude adjustment levers, and the open and closed positions of the throttle marked; also either a band of luminous paint or a noticeable raised band of tape that could be easily felt should be placed around the top neutral position at night.

Exhausts

It is very important that a night flying ship show as little exhaust flame as possible. In this respect the XB-1 was practically ideal. The manifolds and pipes remained black with wide throttle and practically no flame appeared at end of pipes. On another of the aeroplanes, the manifold and muffler pipes remained black but sheets of flame came out through the slit in the muffler for several inches making a band of light very difficult to look past at the ground and producing a blinding effect on the pilot and observer. This type of muffler would be unsatisfactory for a night flying ship. The manifolds of the aeroplanes equipped with Liberty motors got nearly white hot almost to the ends of the pipes and flame appeared two to three feet out of the ends of the pipes. This not only produced a blinding effect in looking straight down and to the rear, but would be very bad indeed in the presence of night pursuit, as it provided an illumination that could be seen for some distance. It is recommended that experiments be carried out with a view to designing manifolds and pipes for the Martin that will give the same effect as those of the XB-1.

Parachute Flares

The tests conducted with parachute flares were very unsatisfactory as only a few opened and lighted. This, however, was due to the poor quality of the particular flares used, they being old stock in storage since 1918. The few which worked showed conclusively that they would be of the greatest aid in picking a field in case of forced landing, and there is no question but that they must be included in standard equipment for night flying ships. It is thought that some very profitable experiments might be made with a view to producing a more efficient, reliable and lighter weight parachute flare than the present standard which is the French Michelin flare.

Beacon Lights

A small beacon light of French manufacture was observed from various angles, altitudes and distances up to ten miles. The results were so satisfactory, in spite of mist and fog, that it is believed a larger beacon light of this general type should be constructed. The cost of this large light will be very much less than that of any commercial type of acetylene operated beacon. The Navy type of "blinker" light, as arranged for secret signalling was observed during the same flight, but it was not sufficiently powerful to be visible at the longer distances.

Goggles

An accident to one of the ships during the May tests strongly brought out the dangers of using amber colored glasses for night work. The danger of using colored goggles of any kind in night flying cannot be overestimated.

THE VARIATION OF AEROFOIL LIFT AND DRAG COEFFICIENTS WITH CHANGES IN SIZE AND SPEED

By WALTER S. DIEHL

Bureau of Construction and Repair, U. S. N.

THIS report, prepared by Walter S. Diehl at the request of the National Advisory Committee for Aeronautics, contains the results of an investigation of existing scale correction data and the derivation of an original method for making these corrections rapidly and accurately. The following summary outlines briefly the subject as treated in the report.

Summary

1. General statement of the principle of dynamic similarity as applied to the problem of determining the variation of the lift and drag of an aerofoil with (variations in) the size and speed.

2. Interchangeability of v and l. Notes on limitations as found by experiment.

3. Review of existing scale correction data. Criticism and comments on the method employed by the N. P. L.

4. Determination of the variation of D_c with scale. It is shown that the minimum drag varies as $(vl)^{1.84}$ in a number of tests and must therefore be due almost entirely to a viscosity effect. Assuming that any increase in the drag coefficient, over the minimum, is due to inertia effects, the relation between the drag coefficients at any angle for the values of vl is

$$D_{c2} = D_{c1} - D_{c0}\left[1 - \left(\frac{v_2 l_2}{v_1 l_1}\right)^{-0.16}\right]$$

where

D_{c2} = drag coefficient at $v_2 l_2$

D_{c1} = drag coefficient at $v_1 l_1$

and

D_{c0} = minimum drag coefficient at $v_1 l_1$

The formula is checked by test results.

5. Variation of L_c with scale. It is found that at any given angle of attack the lift coefficients for the two values of vl bear the relation

$$L_{c2} = L_{c1} + \triangle L_c$$
$$= L_{c1} + .057 \log_{10}\left(\frac{v_2 l_2}{v_1 l_1}\right)$$

where

L_{c2} = lift coefficient at $v_2 l_2$

L_{c1} = lift coefficient at $v_1 l_1$

The value of the constant 0.057 was determined from existing experimental data.

6. Applications and limitations. Method of applying formula. Discussion of limitations.

7. Conclusions.—It is recommended that the formulæ be checked by accurate tests made for this purpose and extending over a large range of vl.

Introduction

A general expression for the resistance or reaction due to relative motion between a fluid and an immersed body may be written by application of the principle of dimensional homogeneity. If the motion be uniform and the fluid incompressible it is found that the reaction is given by

$$R = p v^2 l^2 f\left(\frac{vl}{\nu}\right) \qquad (1)$$

where

p = density of the fluid,

v = relative velocity,

l = some linear dimension of the body,

μ = viscosity of the fluid,

and

$\nu = \frac{p}{\mu}$, the kinematic viscosity.

The derivation of the expression is due to Lord Rayleigh[1] and may be found in any treatise on aerodynamics. (See Bairstow, "Applied Aerodynamics," Ch. VIII.)

In most aeronautical engineering computations it is customary to neglect the variations of ν and to consider only variations of v and l. This is justified since model tests and flying are usually carried out under conditions which render ν substantially constant. The product of the velocity, v, in feet per second, and the chord, l, of an aerofoil in feet is then referred to as the "vl" or "scale" of the test or flight.

This investigation is concerned with the determination of the functions of vl which express the variations of lift and drag coefficients of an aerofoil, with particular reference to the application of model tests to full-size aeroplane performance.

Before discussing the previous work in this field it seems desirable to call attention to certain phenomena connected with the limitations of the interchangeability of v and l.

Interchangeability of V and L

It should be noted that the condition of dynamic similarity, which may be expressed $v_1 l_1 = v_2 l_2$, presupposes geometrical similarity. This is equivalent to saying that geometrically similar aerofoils will give identical characteristic curves when tested at speeds inversely proportional to their chords.

This interchangeability of v and l and the dependence of aerofoil coefficients upon their product has been accepted for many years as being necessary from a physical standpoint. The validity of the assumption has sometimes been challenged but never disproved. On the other hand the results of various tests such as those made at N. P. L. on two geometrically similar aerofoils (Br. A. C. A., R. and M. No. 148) and at Göttingen on several series of geometrically similar aerofoils. (Kumbruch—Zeitschrift für Flugtechnik und Motorluftschiffahrt, May 31, 1919) are to be taken as positive proof.

However, it is well known to everyone who has had occasion to study the results of many aerofoil tests that there are certain limits within which it is necessary to keep both v and l, if the data are to be reliable. For instance, if the velocity of the wind during a test be less than 30 f. p. s., or if the chord of the model be less than 3 inches, the flow is determined not only by the aerofoil section but also by the method of supporting the model and the quality of the air flow, or turbulence present in air stream. The upper limit to velocity depends chiefly upon compressibility and may arbitrarily be set at 200 f.p.s., at which speed the effect is of the order of 1 per cent.

It may therefore be said with some confidence that the laws connected with dynamic similarity apply to aerofoils subject to the limitations just mentioned.

N. P. L. Scale Corrections

By far the greatest amount of testing for scale effect has been done at the National Physical Laboratory. In a series of three reports of the British Advisory Committee for Aeronautics (R. and M. Nos. 72, 110, and 148) monoplane aerofoil characteristics for the R. A. F.—6 section and modifications are given for values of vl from 2.5 to 40. In another report (Br. A. C. A., R. and M. No. 196) Biplane R. A. F.—6 characteristics are given for values of vl from 5 to 16.5. In addition to these systematic tests a large number of aerofoils have been tested at two or more speeds.

Although the data on scale effect thus accumulated are comparatively extensive, it appears that but little attention has been given to the actual determination of the laws involved. It has been customary since R. and M. No. 72 was published to plot scale tests with the aerofoil characteristics as ordinates and vl (or log vl) as abscissae, drawing a line for each angle of attack through the values of L_c, D_c, or L/D at the corresponding values of vl. This method will give satisfactory results only so long as the curves are used on similar aerofoils. On account of the great gap between the highest vl obtainable in the present wind tunnel tests and the vl of the average machine in flight, it leads to a conclusion which is in error. Figures 1, 2 and 3 are taken from a report by Mr. E. F. Relf, "An Empirical Method for the Prediction of Wing Characteristics from Model Tests, Compiled from Existing Experimental Data" (Br. A. C. A., R. and M. No. 450, June, 1918), and presumably represent the latest N. P. L. scale correction data. In the summary to this report the following conclusion is given: "With regard to the $\frac{vl}{v}$ correction it appears-- that the model results can be directly applied without any great error, if the wing vl of the test is greater than 25 in ft.^{2}/sec." It had been stated in a previous report (Br. A. C. A., R. and M. No. 72. Sec. VI) that there was no scale effect above a vl of 40. Referring to figures 1, 2, and 3 it appears on first sight that there is ample basis for this conclusion. However, if the curves from figures 1 and 3 be replotted on a logarithmic scale as in figures 4 and 5, it immediately becomes evident that the effect of scale is operating according to the same law at $vl = 40$ as at lower values of vl. It is in order to mention that this effect has been noted in a more recent report (Br. A. C. A., R. and M. No. 656, November, 1919), which states that "The drag coefficient of the model is still changing with speed at the highest speed of the experiments. The same is true of the lift coefficient to a very small extent."

The greatest difficulty experienced in applying the correction curves of figures 1, 2, and 3 occurs with high lift aerofoils, such as the RAF — 19. In general it is found that the method is rather unsatisfactory on account of its limitations.

Variation of D_c with Scale

An inspection of figure 5 will reveal two outstanding features. First, that the minimum drag coefficient, or rather the drag coefficient at an angle attack corresponding very nearly to the minimum drag, decreases as vl is increased in such a manner that all of the values lie on a straight line which has the slope — 0.14. This indicates that the minimum drag varies as $(vl)^{1.86}$ instead of $(vl)^2$, and is consequently due almost entirely to skin friction, or more properly, perhaps, to a "viscosity effect." Second, that the higher values of Dc do not follow the same law, since the successive values of Dc, as *vl* is increased, lie on lines which are concave upward. Before drawing any conclusions from these observations it is desirable to examine a number of tests to see if the phenomena are universal.

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[1] Br. A. C. A., R. and M. No. 15.

Upon plotting to a logarithmic scale, as in figure 5, the drag coefficients from available tests, there is obtained in every case a group of lines very similar to those in figure 5. It is to be noted that the slope of the line representing minimum drag is slightly greater in the groups obtained from test data. This slope is quite unform and of the average value —0.16. A specimen group is given in figure 6 to illustrate the general nature of all.

It can therefore be shown that the minimum drag of an aerofoil is almost entirely due to a viscosity effect, which is to say that

minimum drag $\propto (vl)^{1.84}$

or minimum $D_c \propto (vl)^{-0.16}$ .... (2)

Now so long as the flow over the aerofoil is nonturbulent, the magnitude of the viscosity effect can not change by any great amount. But it has been shown by Betz (Technische Berichte 1—4, for translation see N. A. C. A., T. N. No. 41) that

$$D_{ci} = \frac{2L_c^2}{\pi}\,\frac{S}{b^2} \qquad \text{.........(3)}$$

where S = the area of the aerofoil,
b = the span,

and D_{ci} = the coefficient of the "induced drag." That is D_{ci} is a measure of the inertia reaction, in the direction of flight, experienced by aerofoil in imparting to the encountered air the downward deflection which produces the lift represented by L_c. Since D_{ci} is an inertia effect it must vary as $(vl)^2$. Consequently the total drag, which is assumed to vary as $(vl)^2$, has two components, the one varying as $(vl)^{1.84}$, the other as $(vl)^2$. The scale correction to the coefficient of total drag, D_c, must therefore be concerned only with that part of the drag which varies as $(vl)^{1.84}$, and since this part is due to an effect which renders it practically constant over the range of angles corresponding to steady flow it follows that the effect of a change in *vl* is to add to or subtract from each value of D_c a constant amount. This may be expressed in symbols as:

at v_1l_1, $D_{c1} = D_{ci} + D_{cv}$ .... (4)
at v_2l_2, $D_{c2} = D_{ci} + D_{cv} \pm \Delta D_{cv}$ ... (5)
or $D_{c2} - D_{c1} = \pm \Delta D_{cv}$ .... (6)

where D_{ci} = that part of D_c due to inertia effects and varying as $(vl)^2$.
D_{cv} = that part of D_c due to viscosity effects and varying as $(vl)^{1.84}$.
ΔD_{cv} = the correction to D_{cv} necessary to allow for the fact that D_{cv} varies as $(vl)^{1.84}$ instead of $(vl)^2$.

In order to obtain a definite check upon the above conclusions it is necessary to compare at each angle the drag coefficients obtained from tests on an aerofoil at two values of *vl*. There should be a difference between the two coefficients at each angle (within the limits previously stated), of ΔD_{cv}, which is given by

$$\Delta D_{cv} = D_{cv} - D_{cv}\left[\frac{(v_2l_2)^{1.84}}{(v_1l_1)^2}\right]$$

$$= D_{cv}\left[1-\left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right] \qquad \text{.............(7)}$$

Since D_{cv} is substantially equal to the minimum value of D_c, which may be denoted by D_{co}, the above expression may be written

$$\Delta D_c = D_{co}\left[1-\left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right] \qquad \text{.......(8)}$$

A number of tests have been compared on this basis in the manner illustrated by Table I, the results being tabulated in Table II. It is found that the values of ΔD_c are not only very nearly constant but that they check very closely with values given by equation 8. It is particularly to be noted that the aerofoil sections listed in Table II include every type from the double cambered RAF—20 to the deeply cambered RAF — 19. The RAF — 20 has a very low D_{co} and the RAF—19 a very high D_{co}, yet the calculated and observed values of ΔD_c agree very well in each case. This agreement is to be interpreted as a strong confirmation of the formula, which appears to be a very satisfactory approximation applying equally well to all aerofoils.

For convenience in making corrections and comparisons the expression

$$\left[1-\left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right]$$

has been plotted in Fig. 8.

VARIATION OF Lc WITH SCALE

There is very little to be learned from an inspection of figure 4 in regard to the variation of *Lc* with *vl*. These data when plotted on logarithmic scales agree very well with figure 4 but are disappointing on account of the low ranges of *vl*. A typical plot is given in figure 7 to illustrate the general appearance of test data.

If a careful study be made of the various tests it will be observed that the effect of increasing *vl* is to increase by a small amount each lift coefficient within the range of angles corresponding to nonturbulent flow. It will also be observed that the average increase in *Lc* is the same absolute quantity when *vl* is increased, for example, from 5 to 10 as from 10 to 20. That is to say, the average value of ΔL_c is proportional to the ratio $\left(\frac{v_2l_2}{v_1l_1}\right)$ and increases arithmetically as *vl* increases geometrically. ΔL_c should therefore be given by an expression of the form

$$\Delta L_c = K.\ \log\left(\frac{v_2l_2}{v_1l_1}\right) \qquad (9)$$

where K is a constant to be determined from test data.

Table III contains data from a series of tests on two RAF—6a aerofoils with the corresponding values of ΔL_c. The same method was employed on other tests to obtain the values of ΔL_c given in Table IV. The results are surprisingly consistent when consideration is given to the

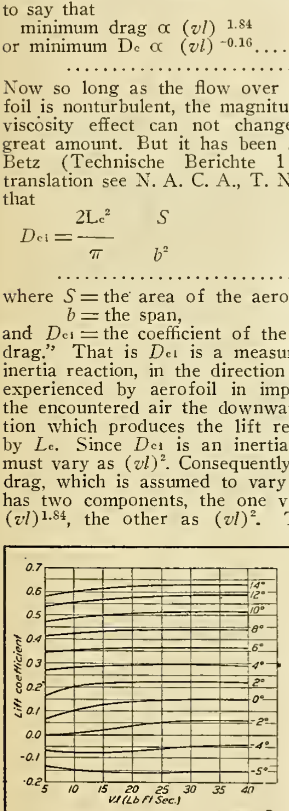


FIG. 1.—Correction to lift coefficient for scale effect. Reproduction of figure 19, B. A. C. A. R. & M. No. 450.

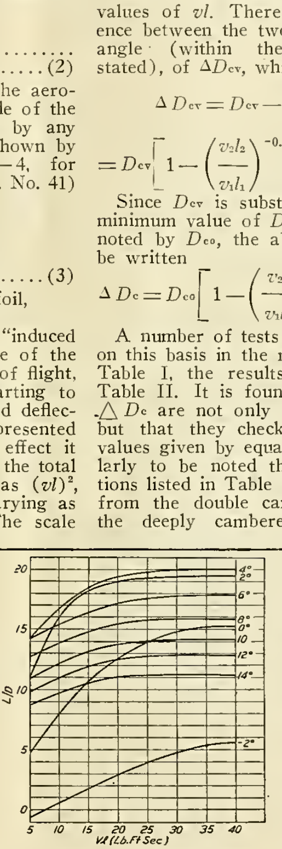


FIG. 2.—Corrections to L/D for scale effects. Reproduction of figure 20, B. A. C. A. R. & M. No. 450.

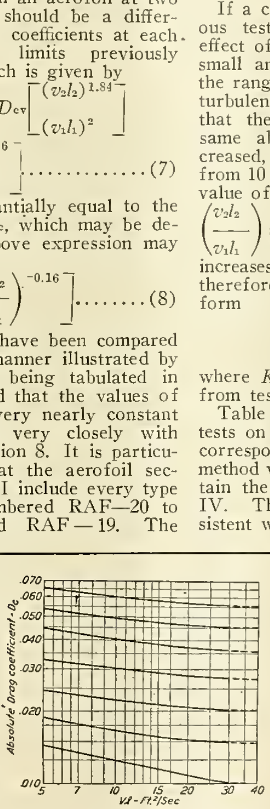


FIG. 5.—Variation of drag coefficient with Vl. Re-plot of figure 21, B. A. C. A. R. & M. No. 450. (See Fig. 3.)

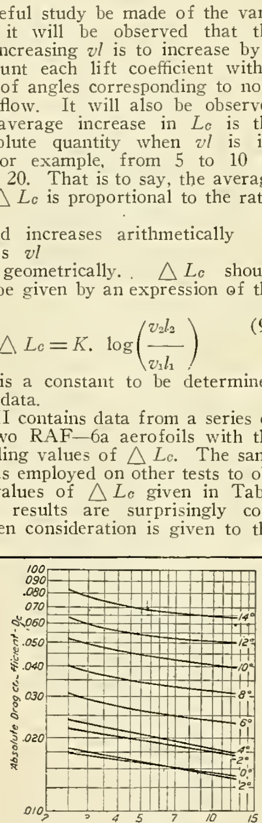


FIG. 6.—Variation of drag coefficient with Vl. Data from B. A. C. A. R. & M. No. 110. R. A. F. 6 Aerofoil.

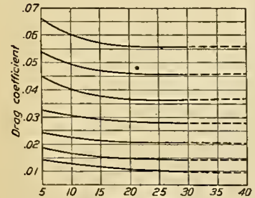


FIG. 3.—Correction to drag coefficient for scale effect. Reproduction of figure 21, B. A. C. A. R. & M. No. 450.

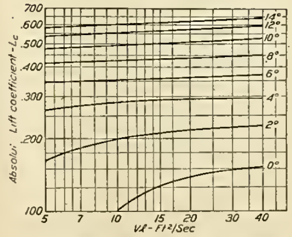


FIG. 4.—Variation of lift coefficient with Vl. Re-plot of figure 19, B. A. C. A. R. & M. No. 450. (See Fig. 1.)

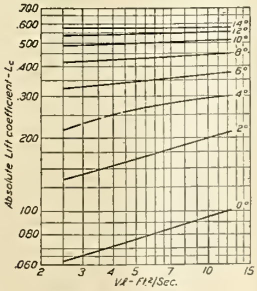


FIG. 7.—Variation of lift coefficient with Vl. Data from B. A. C. A. R. & M. No. 110. R. A. F. 6 Aerofoil.

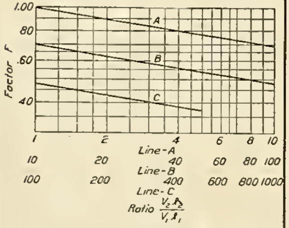


FIG. 8.—Evaluation of $F=\left[1-\left(\frac{V_2l_2}{V_1l_1}\right)^{-0.16}\right]$

fact that $\triangle L_c$ is obtained as the differences between two nearly equal values of L_c, each subject under the best of conditions to an error of 2 per cent or more. The average of a number of readings should eliminate such errors, however.

Table IV contains all data used in the determination of K, which is found to be
K = .057

The value of the lift coefficient L_{c2} at a given angle of attack and v_2l_2 is therefore given by

$$L_{c2} = L_{c1} + .057\ \log_{10}\left(\frac{v_2l_2}{v_1l_1}\right). \qquad (10)$$

where L_{c1} is the lift coefficient at the same angle and v_1l_1.

It is to be noted that the value of K seems independent, not only of the type of aerofoil section but also of the arrangement, i. e., monoplane or biplane.

The method has been applied to tests on a complete model aeroplane (Br. A. C. A., R. and M. No. 656) with satisfactory results. It is unfortunate that free flight test data available for comparison are too erratic to be used, except at large angles where it checks very well with that calculated by 10.

Applications and Limitations

In applying these corrections it is necessary to employ data obtained at a vl sufficiently high to eliminate all uncertainty in regard to steadiness of flow. There are so many factors which influence steadiness of flow that it is difficult to specify a lower limit to vl although in general it may be said that the results obtained from tests on a model of 3" chord at 40 f. p. s. are reliable, but neither velocity nor chord should ever be less than these figures.

The application of the corrections should also be limited to the range of angles corresponding to steady flow roughly from zero lift to maximum lift.

In regard to limitations, there have been tests on certain double cambered aerofoils in which the lift coefficient was found to decrease as vl was increased. Data are lacking to indicate the cause of this reversal, but since other double cambered aerofoils behave in the usual manner it is possible that the phenomena may be due to some special condition or type of flow.

In a few cases, the lift curves for tests at two or more values of vl on the same aerofoil coincide over a range of several degrees in the angle of attack. Special tests are required to indicate whether or not an individual correction of the same general form as equation 10 should be applied at each angle of attack in such cases.

Conclusions

It has been shown that the value of the drag coefficient varies with vl according to the expression.

$$D_{c2} = D_{c1} - D_{c0}\ \left[1 - \left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right] \qquad (11)$$

where D_{c1} is the drag coefficient at a given angle of attack and v_1l_1.

D_{c0} is the minimum drag coefficient at v_1l_1 and D_{c2} is the drag coefficient at the same angle of attack as D_{c1} but at v_2l_2.

It has also been shown that the lift coefficient at v_2l_2 is given by

$$L_{c2} = L_{c1} + 0.57\ \log_{10}\left(\frac{v_2l_2}{v_1l_1}\right) \qquad (10)$$

where L_{c1} is the lift coefficient at v_1l_1 for the particular angle of attack under consideration.

The most obvious criticism of these formulæ is that they are based on low values of vl. The only tests at high values of vl, available for inclusion in this study were those made at Göttingen and reported by Kumbruch in the Zietschrift für Flugtechnik und Motorluftschiffahrt, of May 31, 1919. Unfortunately the forces involved in the Göttingen tests were so large that the models deflected until the angles of attack were uncertain. The models were also of aspect ratio 2.5 and end plates were used to eliminate the tip losses. Although corrections were made for aspect ratio and the interference between the model and the walls of the tunnel it is felt that the effect of scale is not given by the final results.

It is recommended that the formulæ 10 and 11 be checked by tests extending over a large range of vl. Such tests should be made with more than usual care in measuring the angle of attack and wind velocity. The results so obtained should be checked with reliable free flight performance data.

TABLE I—*Determination of Dc, monoplane R A F-6.* (Data from Br. A. C. A., R. and M. No. 110.)

a	Dc $v_1l_1=7.5.$	Dc $v_2l_2=12.5.$	—ΔDc	
-6. .	0.0377	0.0370	0.0007	
-4 .	.0255	.0250	.0005	$\left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16} = (1.67)^{-0.16} = 0.923$
-2. .	.0183	.0170	.0013	
0. . .	.0152	.0138	.0014	
2. . .	.0152	.0135	.0017	
4 . .	.0190	.0173	.0017	Minimum D_{c0}=.0152
6. .	.0244	.0235	.0009	
8. . .	.0331	.0313	.0018	$\Delta D_c = D_{c1} - 0.923\ D_c$
10. .	.0418	.0398	.0020	
12. .	.0514	.0510	.0004	$=0.077 \times .0152$
Average. .	. . . .	. . . .	.00124	=.00117.

TABLE II—*Comparison of Dc calculated and observed.* (See Table I.)

v_1l_1	v_2l_2	$\frac{v_2l_2}{v_1l_1}$	Min. Dc	ΔDc calculated.	Average ΔDc observed.	Section.	Arrangement.	Reference.
7.5.	12.5	1.67	0.0152	0.0012	0.0012	RAF-6c	Monoplane	R. and M. 110
5.	12.5	2.5	.0157	.0020	.0022	Do.	Do.	Do.
5.	10	2.0	.0158	.0016	.0012	RAF-6	Do.	Do.
5.	12.5	2.5	.0158	.0020	.0023	Do.	Do.	Do.
5.	20	4.0	.0142	.0027	.0031	RAF-6A	Do.	R. and M. 148
15.	30	2.0	.0119	.0012	.0013	Do.	Do.	Do.
5.	16.5	3.3	.0143	.0023	.0020	RAF-6	Biplane	R. and M. 196
7	12.5	1.67	.0142	.0010	.0013	Do.	Do.	Do.
20.	40	2.0	.0117	.0012	.0012	Propeller	Monoplane	R. and M. 362
30	40	1.33	.0101	.0005	.0006	Do.	Do.	Do.
5 . . .	14.6	2.92	.0410	.0061	.0058	RAF-19	Do.	R. and M. 415
5	10	2.0	.0410	.0041	.0047	Do.	Do.	Do.
5. . . .	10	2.0	.0083	.0008	.0007	RAF-20	Do.	Do.

TABLE III—*Test data from R. and M. No.* 148, *showing method of obtaining ΔLc.*

a	vl=5 Lc	vl=10 Lc	vl=15 Lc	vl=20 Lc	vl=30 Lc	vl 30–vl 5 ΔLc	vl 30–vl 10 ΔLc	vl 30–vl 15 ΔLc	vl 30–vl 20 ΔLc
—4.	—0.066	—0.064	—0.074	—0.066	—0.048	0.018	0.016	0.026	0.018
—2.	— .061	+ .010	+ .022	+ .037	+ .060	.061	.050	.038	.023
0.	+ .068	.102	.127	.136	.145	.077	.043	.018	.009
2.	.162	.207	.215	.214	.218	.056	.011	.003	.004
4 . . .	.269	.284	.283	.286	.293	.024	.009	.010	.007
6	.346	.355	.357	.358	.365	.019	.010	.008	.007
8. . .	.413	.424	.431	.434	.441	.028	.017	.010	.007
10. .	.472	.489	.500	.505	.513	.041	.024	.013	.008
12.	.537	.551	.563	.572	.585	.048	.034	.022	.013
14 .	.577	.584	.615	.616	.627	.050	.043	.012	.011
Average ΔLc	. . . . . .	. . . . . .	. . . . . .	. . . .	. . . .	.0422	.0257	.0160	.0107

TABLE IV—*Determination of K in the equation.*

$$[L_{c2} = L_{c1} + K.\log_{10}\left(\frac{v_2l_2}{v_1l_1}\right).]$$

No.	v_1l_1	v_2l_2	Average ΔLc	$\frac{(v_2l_2)}{(v_1l_1)}$	$\log_{10}\frac{(v_2l_2)}{(v_1l_1)}$	K.	Section.	Reference.
1.	2.5	5	0.0174	2	0.3010	0.0578	Monoplane RAF 6.	R. and M. No. 110
	5	10	.0170	2	.3010	.0564		
	2.5	12.5	.0394	5	.6990	.0564		
2	5	30	.0422	6	.7782	.0542	Monoplane RAF 6c	R. and M. No. 148
	10	30	.0257	3	.4771	.0538		
	15	30	.0160	2	.3010	.0532		
	20	30	.0107	1.5	.1761	.0608		
3.	5	10	.0173	2	.3010	.0572	Biplane RAF-6	R. and M. No. 196
	5	16.5	.0329	3.3	.5185	.0635		
	7.5	12.5	.0138	1.67	.2219	.0622		
	7.5	16.5	.0217	2.2	.3424	.0632		
4.	40	35	-.0034	.875	-.0581	.0585	Propeller aerofoil. x/c=0.5 $\frac{h}{c}$=.075	R. and M. No. 362
	40	30	-.0063	.750	-.1239	.0510		
	40	25	-.0116	.625	-.2041	.0568		
	40	20	-.0176	.50	-.3010	.0585		
5.	5	10	.0176	2	.3010	.0585	Monoplane RAF-19	R. and M. No. 415
	5	14.6	.0238	2.92	.4654	.0511		
6.	5	14.6	.0267	2.92	.4654	.0574	Monoplane RAF-20	R. and M. No. 415
Average.	. . . .	. . . . .	. . . . . .	. . . .	. . . .	.0570	. . . .	

OPERATING TESTS OF MAGNETICALLY OPERATED STARTING SWITCHES

THE object of these tests was to determine whether or not the magnetically operated starting switches supplied by the Bijur Motor Appliance Co., Hart Manufacturing Co., and the United States Light & Heat Corporation were satisfactory for aeroplane use.

Time and Place

Samples of each of these three types of switches were tested by the Electrical Branch of the Equipment Section at McCook Field, Dayton, Ohio, October 27, 1920.

Description of Switches

The switch manufactured by the Bijur Motor Appliance Co. is an adaptation of their standard manually operated switch.

Switches manufactured by the Hart Manufacturing Co. and the United States Light & Heat Corporation were especially designed for use as remote control switches. Photographs of these types of switches are embodied in this report.

Method of Test

The source of power for these tests was a standard 600-watt propeller-driven generator, belt connected to a Liberty engine. The overload cut-out on this generator was held shut and the voltage regulator field resistance was shorted in order to obtain approximately 300 per cent overload momentarily. The load used was a standard Bijur propeller end starter as arranged for "Liberty 12."

The operating test consisted of closing the switch which was in series between the generator and the starting motor for time intervals sufficient to allow the starting current to reach a maximum value of approximately 150 amperes. When the maximum current value was reached the switch was opened under load. This process was repeated in rapid succession 1,000 times for each switch. The switch was then disassembled and examined for signs of wear, burning, or pitting of contacts. At the conclusion of the operating tests the solenoid coils of these switches were placed on a normal voltage heat run, which was continued until the maximum temperature shown by resistance measurements was reached. At the conclusion of the heat run the standard high potential test of 500 volts alternating current was applied in the usual manner.

Results of Tests

	Pounds.
Weight of Bijur switch	2.90
Weight of U. S. L. switch	2.40
Weight of Hart Switch	2.70

(Concluded on page 522)

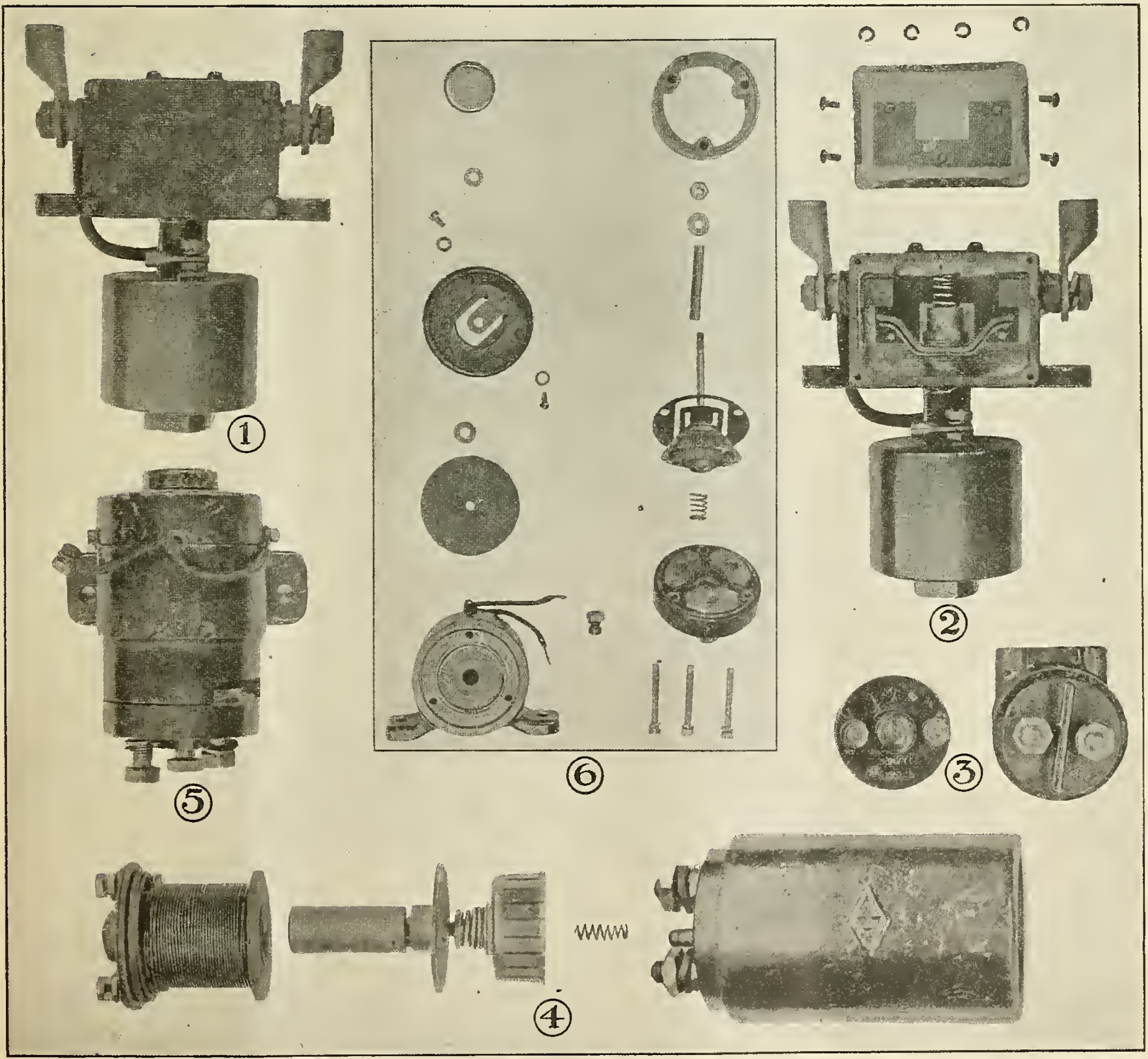
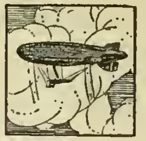


Fig. 1—Bijur magnetically operated starter switch. Fig. 2—With cover plate removed. Fig. 3—End view. Fig. 4—Exploded view. Fig. 5—U. S. L. magnetically operated starting switch. Fig. 6—Parts of U. S. L. magnetically operated starting switch

FOREIGN TECHNICAL DIGEST



The L.F.G.-V3a Flying Boat

The L.F.G.-V3a flying boat is a rigid truss monoplane passenger machine, produced during 1920 by the Strelsund Works of the Luft - Fehrseng - Gesellschaft (L.F.G.) at Berlin. The power-plant consists of a 150 h.p. Benz 6-cylinder engine and recently a 185 h.p. B.M.W. 6-cylinder engine (Bavarian Motor Works). The hull is of very great span, and no side-floats (auxiliary-floats) are used. The hull, the enclosed cabin, the ailerons and the tail (tail-plane, elevators, fin, rudder) are of duralumin metal construction. The ailerons, the elevators and the rudder are of the balanced type. The engine drive, a pusher-airscrew. Three or four passengers can be carried. The main dimensions, weights and performances are the following:—

Engine	150 h.p. Benz or 185 h.p. B.M.W.
Span	14.45 m.
Length	3.50 m.
Height	2.35 m.
Wing area	30 sq. m.
Airscrew diameter	2.70 m.
Weight empty	9.70 kg.
Weight loaded	14.70 kg.
Total load	500 kg.
Wing loading	49 kg. p.sq.m.
Power loading	10.9 kg. p.h.p.
Speed	150 km.p.h.
Fuel capacity	218 ltr.
Range	600-650 km.

(*Aeronautics*, July 7, 1921)

New Italian Airship

Since the sale of the Italian airship *Roma* to the U. S. of America, Italy has ordered the construction of a new big semi-rigid by the Department of Aeronautical Construction.

The main features of this new airship are as follows:

Volume	42,000 c.m.
Length	160 m.
Width	25 m.
Height	27 m.
Engines	12 Spa, 200 h.p. each—total h.p., 2,400.
Maximum speed	110 km. per hour
Normal speed	85 km. per hour
Range	5,600 km. normal speed.

In addition a small semi-rigid for the training of pilots will be built to the following specification:—

Volume	1,100 cm.
Length	40 m.
Width	8.50 m.
Height	13 m.
Engines	2 engines, 35 h.p. each
Maximum speed	75 km. per hour
Range	500 km. with 4 passengers on board.

The price of construction will not exceed that of an automobile *de luxe*.

(*Aeronautics June* 30, 1921)

A Novel Carburetor

The Hannen carburetor, recently placed on the market in Germany, possesses several interesting features. The proper mixture strength to suit atmospheric conditions can be adjusted by means of two micrometer screws. The main jet is a single jet. The slow-running jet communicates by a channel with the suction pipe above the throttle and the amount of mixture passing through this channel is regulated by a tapered drum with holes in it. The air necessary for this jet enters from the suction chamber by a second channel below the throttle. This same channel helps to create a partial vacuum in the slow-running jet at high speeds and thus diminishes the discharge from the main jet.—(Wa. Ostwald, *Auto-Technik*, Feb. 12, 1921. 1½ cols., 1 fig.)

Measuring Temperatures in Internal-Combustion Engines

Mr. P. Ferretti, in an article in the January issue of the *Rivista Marittima*, exhaustively examines this question. After describing the hydrogen gas thermometer, the resistance thermometer and the Callendar, Burstall, Petersen and Wolff instruments and the various results obtained by these experimenters, he proceeds to deal in detail with the thermo-electric thermometer and the experience of Bams, Stronhal and others with this apparatus; he states that measuring the temperature directly and satisfactorily was solved for laboratory purposes and has now been equally solved for industrial purposes in the apparatus described by Professor Belluzo and Commander Cardona.

Reduced to its most simple expression, it is composed of an exploring element (a thermo-electric pyrometer) in contact with the gas inside the engine cylinder and a galvanometer which at any moment gives the measurement of the temperature assumed by the sensitive wire, or the mean ordinate of the temperature diagram, *i.e.*, the mean temperature during the cycle. If care be taken to check the galvanometer during the tests of the engine on the testing bed at various loads and to graduate the quadrant in millivolts or in degrees equivalent to I.H.P., or, better still, shaft H.P., the galvanometer index will give at any moment the I.H.P., or, better, the E.H.P., and thus the apparatus will serve as an instantaneous power indicator.

When it is a question of a multiple cylinder engine it is quite sufficient to arrange an exploring element on each cylinder connecting all these up successively to the same galvanometer by means of a revolving commutator worked by the engine itself. The value of this lies in the fact that an idea of what is taking place in the several cylinders can be obtained immediately without requiring any operation on the part of the man in charge of the engine.

Frequently with internal-combustion engines, and with the Diesel type in particular, a cylinder is over-loaded owing to combustion in the other cylinders not having developed the necessary power due to imperfect pulverization of the fuel, etc. This possibility is carefully watched on the testing bench, but once the engine is in place rule of thumb methods hold the field, which should not be, and engineers should have some method whereby the combustion process in the cylinder can be watched. —(*Rivista Marittima*, Jan., 1921. 62 pp., 37 figs.)

(*Concluded from page* 521)

DATA FOR BIJUR SWITCH

Switch stuck closed six times during the operation test and was badly pitted when disassembled.

Heat run data

Time.	Volts.	Amperes.
12.50	12.00	3.45
.55	12.00	2.85
1.00	12.00	2.65
.05	12.00	2.55
10	12.00	2.50
.15	12.00	2.50
.20	12.00	2.50

High potential test broke down at 500 volts.

Closing amperes, 0.6.

Closing volts, 2.0.

DATA FOR U. S. L. SWITCH

Gave no trouble and showed no signs of wear.

Heat run data

Time.	Volts.	Amperes.
1.30	12.00	3.7
1.35	12.00	3.4
1.40	12.00	3.35
1.45	12.00	3.23
1.50	12.00	3.1
1.55	12.00	2.98
2.00	12.00	2.9
2.05	12.00	2.83
2.10	12.00	2.78
2.15	12.00	2.76
2.20	12.00	2.75
2.25	12.00	2.75
2.30	12.00	...

High potential test at 500 volts satisfactory.

Closing amperes, 1.55.

Closing volts, 5.00.

DATA FOR DIAMOND-H SWITCH

Gave no trouble and showed no signs of wear.

Heat run data

Time.	Volts.	Amperes.
1.30	12.00	7.2
.35	12.00	6.3
.40	12.00	6.2
.45	12.00	5.9
	(Coil smoking.)	
.50	12.00	5.7
.55	12.00	5.5
2.00	12.00	5.4
.05	12.00	5.4
.10	12.00	5.4
.15	12.00	5.3

High potential test was satisfactory.

Closing amperes, 4.5.

Closing volts, 3.5.

Conclusions

The Bijur switch is unsatisfactory.

The Hart switch and the U. S. L. switch are satisfactory for production.

The Diamond-H switch is considered to be a good production model, as it is completely waterproof, contains very few parts which are liable to get out of order, and should be cheaply made.

The U. S. L. switch contains more parts and will be considerably more expensive for production than is warranted by any advantage which it may have.

NAVAL and MILITARY AERONAUTICS

Army Planes Can Talk to Plant 50 Miles Away

Washington.—The use of radio telegraphy and telephony in the Army Air Service is becoming increasingly important. The Engineering Division at McCook Field, Daytan, O., is experimenting with many types of apparatus and making tests in the radio laboratory.

The new apparatus includes a 5-kilowatt spark transmitting set which has a range of about 1,000 miles, a 2-kilowatt tube set with a range of 600 miles, a 1-kilowatt telephone set with a range of several hundred miles and several smaller telephone sets.

In the course of the tests it has been found possible to carry on a conversation between the radio laboratory and planes in the air 50 miles away as readily as between two stations on a ground line.

Radio also is being used in the Air Service for the purpose of assisting in navigation, particularly in the case of "above-the-clouds" flying.

Army Flyer Makes Unusual Landing

San Francisco.—When his engine suddenly stopped 15,000 feet in the air above remote Crater Lake, Oregon, Raymond G. Fisher, Forest Service pilot, was forced to land on a tiny island in the lake, which is in the pit of an extinct volcano with walls 1,000 feet high surrounding it, forestry officials announced here today.

The plane was not damaged in the descent, but Fisher upon examination found four of the spark plugs of the engine broken.

Using the wireless set with which the machine was equipped he succeeded in getting in touch with another Forest Service plane.

This second flyer hastened to Medford, Ore., and obtained new spark plugs for Fisher's plane. Arriving back at the lake, however, the rescue pilot found it impossible for another plane to land on the island or apparently to get the plugs to Fisher. Other Forest Service planes came up and sets of spark plugs were sent to earth by means of parachutes. Hunting with a torch Fisher found one of the parachutes and repaired his machine and "took off" from the island, reaching the Forest Service aeroplane base at Medford safely.

Mr. Bull Frog Takes a Joy Ride

From the Philippines comes a story of how a daring and intrepid bull frog nonchalantly leaped into the cockpit of one of Uncle Sam's aeroplanes and sat through the whole gamut of stunts known to "aeroplane stuntdom" without blinking an eye, acting as though he had been an old veteran in the game.

A few days ago Lieut. C. L. Webber was obliged to fly to Manila. After transacting his business he returned to Paranaque Beach, having failed to toss a single libation to Hymen. With due circumspection and thoroughness he proceeded to give his chariot the "once-over". She appeared to be a model of perfection, whereupon he vaulted into the cockpit and pushed off with never a qualm.

He had climbed to two thousand feet and his rythm of motion was purring her "sans souci" to him, when out of the corner of his eye he thought he detected untoward activity in the cockpit. He lowered his head, but could not be sure. He removed his goggles, but still doubt remained. He withdrew his handkerchief and gently caressed his eyes to remove all fauna or flora that might have inadvertently crept therein. He finally centered his gaze upon his rudder bar, for thereon benignly sat a huge bull frog, who intermittently grinned and ogled at him. He opened his throttle and zooned, but Mr. Frog was not perturbed. He side-slipped, he fish-tailed, he banked, and he did wing-overs, but his fellow passenger manifested not the slightest interest, nor would he quit his position on the rudder bar.

At this point Lieut. Webber reports detecting a violent knock in the motor. Soon a miss, first on one side and then on the other developed. He looked at his wings, and they appeared to wobble badly. He thought the ship had developed the ague or the Saint Vitus Dance, she vibrated so terribly. One moment he was positive the motor had stopped, the next he was equally certain his controls were fouled. All the time he was conscious of nothing but rice paddies flying by beneath him.

Lieut Webber finally landed safely on his home field, but before the ship came to a stop a person was seen to leap from the cockpit and run madly to the Flight Surgeon's Office. Fortunately, a psychiatrist was also present in the latter's office. The two after listening to an incoherent mumbling of "bull-frog, bull-frog" proceeded to a minute examination of the ship, whereupon they pronounced the case a very rare one, known as "bull frog on the brain".

Lieut. Webber is now slowly convalescing. He says he would be quite well were it not for the propinquity of his copassenger, who persists in hanging about his quarters at night.

North Island Additions

According to word received at North Island Thursday morning, a $30,000 appropriation was received to cover the cost of three hangars, each 100x300 feet, for land machines of the Martin Bomber type. In addition $20,000 has been appropriated for a storage house and a distributing supply house. Forty thousand gallons of gasoline will be stored.

Work on the new machine shop will soon start, and a new fire house will also be erected.

Radio

The use of radio telegraphy and telephony in the Air Service is becoming increasingly more important, as shown by the radio activities of the Engineering Division at McCook Field. Many types of radio apparatus are being tested and experimented with in the Radio Laboratory. In fact, there is probably no more completely equipped Radio Laboratory in the country than the one at McCook Field.

Work at this time is being done on various types of apparatus, including a 5-kilowatt spark transmitting set which has a range of about 1000 miles, a 2-kilowatt tube set which has a range of about 600 miles, a 1-kilowatt telephone set which has a range of several hundred miles, as well as various smaller radio telephone sets which have ranges of from 15 to 100 miles. In addition to this apparatus, tests are also being conducted with telegraph and telephone apparatus which is used on aeroplanes and includes a telegraph set having a range, from aeroplane to ground, of 100 miles and various telephone sets having a range of from 15 to 100 miles. Thus in the course of tests it is possible to carry on conversation from the Radio Laboratory with an aeroplane which is flying at a distance of 50 miles from the field as easily as it is to carry on conversation over the ordinary wire telephone from the house to the office.

In addition to communication, radio is also being used in the Air Service today for the purpose of assisting in navigation, particularly in the case of "above-the-cloud" flying. By means of direction finding loop stations located on the ground, it is possible to ascertain the bearing and the location of any aeroplane that is flying in the vicinity. Thus, if an aeroplane is flying above the clouds and is in doubt as to its exact location, the radio operator in the aeroplane calls these ground direction finding stations and asks that he be informed as to his whereabouts. These ground direction finding stations immediately take bearings on the aeroplane, and by means of triangulation determine its location. This information is then transmitted to the aeroplane by either radio telephone or radio telegraph.

By means of special radio direction finding loops installed on an aeroplane, it is possible to fly directly towards any radio transmitting station. Thus it is possible for aeroplanes to rise above the clouds and to fly directly to another station without seeing the ground until its arrival and landing.

Manual on Navy Aviation

In order that line officers of the Navy may have an opportunity to study aviation, the Bureau of Navigation has approved the plan for the compilation of a manual on the general subjects of aviation, organization, activities, aeroplanes, engines, equipment, use aboard ship, and other details. When this manual has been compiled and approved, it will be issued to the line officers of the Navy, and thereafter questions on aviation based upon the general subject as treated in the manual, will be part of the examination of line officers. The plan is now under way, but it is not expected that either the manual or the questions for examination will be ready for issue much before the first of next year, or possibly later. A tentative series of questions was submitted to the Bureau of Navigation as an outline of the subject which should be covered in the new manual.

FOREIGN NEWS

Air Route Over Desert

Regions that would have to wait many years before they could be traversed by railways are now quickly mastered by aerial transport. News cames from the British Air Ministry that a new air route has been opened up across the desert between Palestine and Mesopotamia. Notification has been received of the arrival at Bagdad of three aeroplanes of the Royal Air Force which have flown over this route.

The new route is about 580 miles long. It is an extension of the present Cairo-Ramleh route. It starts from Ramleh, where is the main Royal Air Force aerodrome in Palestine, passes through Amman (east of the Jordan) and Kasr Azrak, where landing grounds have been prepared, and proceeds thence in an almost straight line across the Arabian desert to Ramadie, on the Euphrates, and thence to Bagdad.

The distances between the principal stations are as follows: Ramleh to Amman, 65 miles; Amman to Kasr Azrak, 55 miles; Kasr Azrak to Ramadie, 400 miles; Ramadie to Bagdad, 60 miles.

Austrian Helicopter Tested

An article in "The Sphere" states that authentic news has recently reached London of the successful trials of an Austrian helicopter, invented by Lieut. Stefan von Petroczy. This machine has reached an altitude of approximately 160 feet, carrying two men, and flying straight up from the ground by the aid of two larger propellers measuring 21 feet in diameter. The propellers are driven by three rotary air engines working at a speed of 600 revolutions per minute.

Though experiments are taking place in various countries to solve the great problem of vertical flight, this is the first real success in this direction; and the height attained by the Petroczy machine puts it far ahead of its rivals. It is an event in the science of flight as important in its way as the first power-driven flight of the Wright Brothers.

When the helicopter is a proved success, the aircraft of the near future will be able to do without the large aerodromes necessary today. The Petroczy machine is also provided with a large parachute, which at the first sign of engine failure is automatically released, and able to bring the machine safely to the ground.

Shopping by Aeroplane

The latest fad among women in England is to make shopping tours by aeroplane, and they appear very enthusiastic about it, seeming to greatly enjoy every moment they are in the air and manifesting keen delight in the luxury the new aeroplane cabins afford. For their benefit largely the saloons bear dainty flower vases and mirrors.

Paris is the destination of most of the women. By going in a morning express one can now do an hour or so's shopping in Paris and catch a machine back which will bring one to the London air station in time to motor to town for dinner. From one express in from Paris the other evening there emerged eight women and only one man. Two women who wanted to buy a good many things in Paris hired a special "air-taxi," went over in the morning, spending the whole day there, and returned by the scheduled aeroplane express the next morning.

A Flying Boat's Work in Australia

Piloted by Capt. Lang, of the Australian Air Force, a fine four months' cruise on the S.E. coast of Australia has, according to a *Morning Post* correspondent, just been concluded. The "Seagull," the flying boat in question, is privately owned, although she has apparently been doing valuable national survey work, as during her trip all bays and inlets have been photographed and the flying conditions up to 2,000 ft. between Sydney and Tasmania have been tested, with especial attention to the islands in the Bass Strait. The "Seagull" carried on most of the cruise three men, an anchor, and an amount of small equipment, and was accompanied by the motor schooner *Acielle,* which was fitted out with a dark room. During the cruise an officer from military headquarters joined Capt. Lang with secret instructions, which were successfully carried out.

The "Seagull" remained the whole time absolutely unsheltered, took off from all sorts of seas, and outrode several gales (one lasting six days) on her own anchor. Almost constant high winds were found at 2,000 ft., although at the same time it was often dead calm at sea level. The pilot is specially pleased with the boat's behavior in the stormy wintry weather experienced in the Bass Strait. There was no accident throughout the voyage. The "Seagull" is fitted with a 160 h.p. Curtiss engine, measures 29 ft. over all, with a 51 ft. wingspan, weighs two tons, and flew fully laden on a four hours' nonstop flight against a stiff wind at the rate of 55 miles an hour, consuming on that occasion a total of 32 gallons of petrol.

Aviation in West Indies

Once or twice we have referred to the aviation developments, which give promise of materializing in the West Indies, and progress appears to be well in hand. According to a *Times* correspondent, the Bahamas House of Assembly has not only favorably considered a petition from the Bermuda and West Atlantic Aviation Company, asking for a grant of certain subsidies and concessions for the establishment of an air service between Nassau and Miami (Florida) and Nassau and the Out Islands of the group, but is also considering a bill to enable the Governor-in-Council to enter into a contract with the company for the projected service. The company, while identified with the Bermuda concern, will shortly be known as the Bahamas and West Atlantic Aviation Company. Later on both will be registered in London as the West Atlantic Aviation Company, the operations of which will extend from Bermuda to Trinidad. The proposals placed before the Bahamas Legislature include: A subsidy of £5,000 per annum for five years for a daily air service to Miami during the winter and a bi-weekly service for the remainder of the year, the inter-insular service to be provided as required. The local press favors the proposal, and it is pointed out that the colony has everything to gain commercially from such a service, while from the Imperial point of view the colony's duty is to lend support and encouragement to civil aviation.

Italian Government Orders Machines

According to the *Italian Press,* May 10, 1921, the Fiat Company is to supply to the Italian Government two A. R. F. machines, to be followed by two machines (probably the three-engined type) seating 12 passengers, and two machines seating four passengers. Moreover, the Fiat Company is to overhaul all the A.14 engines, fitting them with all recent improvements.

The Ansaldo Company is to supply two A. 300 C., and it is said that an order has been placed for a new squadron of 450 h.p. Caproni machines.

Two S. 13 *bis,* two S. 16 and two S. 16 *bis* have been ordered from the Savoia, and the firm is to undertake the repair of a quantity of naval aviation material.

Gnome Engine Works Destroyed

From Paris it is announced that the Gnome engine works at Argenteuil were destroyed by fire.

French Aviation Firms Are Now Consolidated

Three of the biggest French aviation companies: Astra, Nieuport and the Compagnie Generale Transaerienne have united their forces, with a capital of $5,600,000, nominal exchange. The present offices and factory of the Nieuport company will constitute the headquarters of the new group, of which the general manager will be Marcel Thomas, at present with the Astra company, and chief engineer M. Delage, of the Nieuport company. The new group will be interested in both aeroplanes and airships, and has in hand an order for two hundred planes for the Japanese Government.

Urges French Aeroplane Fleet

Deputy Paul Benazet has introduced a bill into the French Chamber of Deputies which proposes to establish a fleet of 1000 aeroplanes suitable for war, but which can be operated commercially and therefore at little cost to the Government. The author of the measure called attention to the large and extensive aviation personnel of the Government.

British Imperial Air Service

Great Britain is contemplating establishing an air service with its possessions. It would be known as the "Imperial Air Service" and would carry passengers and mail between England, Egypt, India, South Africa, Australia and New Zealand.

The feasibility of the service as well as a recommendation that it be established has been reported on by A. H. Ashbolt, Agent General for Tasmania, and a number of experts. It is proposed a company be formed to take over and utilize airships, plant and equipment now in possession of the Government, which it is understood the authorities are ready to do.

The company would have a capital of £1,500,000, of which half would be issued immediately on the following plan of distribution: Indian Government, £100,000; Australia, £100,000; South Africa, £100,000; New Zealand, £50,000; Malay States, £25,000; general public, £375,000.

Inasmuch as airships, material and equipment are to be given by the British Government and not ranking as capital, Great Britain will have the option of taking up the amount allotted to the general public.

Suggested ports of call are London, Marseilles, Athens, Cairo, Bazrah, Bombay, Colombo, Singapore, Java, Perth, Melbourne, Sydney, Wellington, Mombassa and Cape Town. It is believed such a service would bring England within five days of India and within ten or twelve days of Australia.

Commercial Aeronautics in Europe

In a special dispatch to the New York *Globe* and Chicago *Tribune,* Hiram K. Moderwell states that the approaching abandonment on August 1 of airships as a part of the British military equipment has stimulated civil aviation. While some bitterly oppose such abandonment, asserting that the airship is an indispensable military arm, others show a keen interest in the government's offer to give its five airships and all the existing equipment worth $25,000,000 free to a bona fide British commercial company undertaking to operate them.

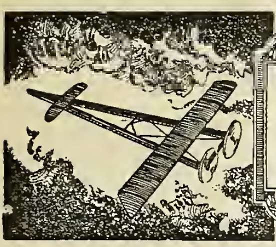
Plans already are well advanced for establishing regular airship service between England, Egypt, South Africa, India and Australia. This would bring South Africa and India within a five days jorney from London and Australia within a ten days' trip.

According to one scheme, a corporation would be formed with a capital of 1,500,000 pounds, England and the dominions contributing half of the capital stock in consideration of the service rendered. This would practically be a subsidy. It is agreed that in the experimental stage, the airships would be run at a heavy loss, but some experts insist that eventually they could be operated at a commercial profit on flights of 2,000 miles or more, meeting the competitive steamship rates.

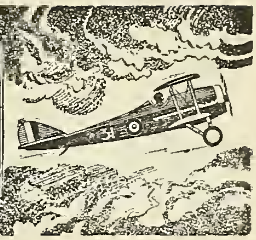
Contemporaneously with the government's offer of the airships comes a government offer of a subsidy for commercial aeroplane lines to the Continent. Two British lines are now operating daily between London and Paris under a temporary subsidy arrangement, but the government eager to enlarge the service, has offered all genuine British commercial lines maintaining a daily service a subsidy of 25 per cent of the gross earnings for three years up to a total of 200,000 pounds (normally $1,000,000) annually. This is for routes between London and Paris, London and Brussels and London and Amsterdam, but it is expected that new routes will be added. The government also will build machines for commercial companies, renting them at 2½ per cent monthly of the cost, the machines becoming the property of the companies after thirty payments.

This offer is a belated effort to meet the competition of the heavily subsidized French lines. In the summer of 1920 the British aircraft traffic to the continent was four times as large as that of the other nations, but this year it has been only one-quarter as large. This is because the French government has instituted a subsidy system enabling the lines to operate roughly at half the cost. This almost put the British lines out of business, but an emergency subsidy enabled them to resume temporarily.

Perhaps it is not generally known how extensive regular commercial aviation has become in Europe in the last year. There are now two French lines between Paris and London, one running three planes daily each way. There are other daily lines between Paris and Brussels, Amsterdam and Rotterdam, Paris and Strassburg and between Bayonne, France, and Santander, Spain. There are also Dutch lines between Amsterdam and London and between Amsterdam and Copenhagen by way of Bremen and Hamburg; also Belgian lines between Brussels and London, Brussels and Paris and Brussels and Amsterdam. A French line makes four regular weekly trips between Toulouse, France, and Casablanca, Morocco, via Barcelona and other Spanish ports. Other French lines make three trips per week to Prague, two trips to Warsaw and also from two to four times a week between Toulouse and Montpelier and Marseilles and Montpelier and Nice.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Aeroplane Characteristic and Performance Table Eliminates Mathematical Calculations

THE table given below is the result of many calculations made for the purpose of determining the various speeds obtainable with different wing loadings and with different lift coefficients. Messrs. William Wait and George A. Page, who compiled the figures in the table, were engaged in figuring on the low speeds possible to obtain with light loading and high lift coefficients, as an aid in the design of a small plane of low horsepower. So that the results of these calculations could be compared one with another, they were set down in table form and extended to include wing loadings begginning with three pounds per square foot and listing the speeds at intervals of half a pound up to fifteen pounds per square foot. For these loadings the speeds are listed for coefficients beginning with .00001 and including all the coefficients up to .00036. These figures include about all the coefficients likely to be considered in the design of a small light aeroplane, yet it will be found to be complete enough to enable many characteristics to be determined of some of the larger planes.

To those who have occasion to use the table, its handiness will be self-evident. The figures were obtained by listing, within the limits mentioned, the results of the formula

$$\frac{\sqrt[3]{\text{lbs./sq. ft.}}}{\text{ky}}$$

; that is, the cube root of the pounds per square foot, divided by the ky or lift coefficient. From this it will be seen the number of calculations necessary to arrive at a solution without this table. By comparing the various results obtainable at a given wing loading the selection of a wing section suitable for the desired speed is greatly simplified.

When two factors of the aeroplane's characteristics are known, the third characteristic may be found in the table. For example, when the loading in pounds per square foot is known or assumed, and the lift coefficient for the maximum angle of the wing curve is known, the table will show the corresponding speed in miles per hour that can be expected. Another use to which the table may be put is in discovering the lift coefficient necessary to carry a given loading at a given speed. Determinations can also be made which will assist in finding out the best incidence angles for high and low speeds, the amount of surface necessary to obtain different speeds, etc. After the head-resistance and speed have been calculated, the table will show what lift coefficient is required.

It will be observed that the figures in the table are lined up in mathematical progression. This is most evident in the speed of seventy-one miles an hour, which extends diagonally across the table. A careful observance of the arrangement of the figures discloses other points of symmetry and illustrates the comparative characteristics with about as much precision as a series of graphs or curves.

"Aeroplanette" Club Suggested

The organization of an association or club to foster the "Aeroplanette" or light-weight aeroplane, has been suggested by Mr. Cortlandt S. Parker, of 407 East 19th Street, New York City. As Mr. Parker expresses it, his idea is "to get as many people in and out of the air as safely and economically as possible." In this connection he believes that the formation of an association as mentioned above would greatly popularize the aeroplane.

An organization formed along the lines of the "Federation of American Motorcyclists" would stimulate interest in aviation among the general public. Such matters as limiting the cylinder displacement of the engines and reducing the landing speed would help give the public faith in the efficiency and safety of a well-developed aeroplane, for as the motorcycle is to the automobile, the aeroplanette is to the aeroplane.

As many young men have sufficient experience to attempt the construction of a machine of this type, but have not the facilities for housing a large plane, an aeroplanette club would seem to present an ideal outlet for their talents. As there is no organization around New York City devoting its time to an idea of this nature, Mr. Parker would be interested in hearing from parties interested enough to assist in organizing such a club, with a view to building light aeroplanes of the type described.

LOADING IN POUNDS PER SQUARE FOOT	LIFT COEFFICIENT (Ky)																																		
	.00001	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	.00036
3	173	122	100	82	77	71	65	61	58	55	52	50	48	46	45	43	42	41	40	39	38	37	36	35	35	34	33	33	32	32	31	31	30	30	29	29
3.5	187	132	108	94	84	76	71	66	62	59	56	54	52	50	48	47	45	44	43	42	41	40	39	38	37	37	36	35	35	34	34	33	33	32	32	31
4	200	141	115	100	89	82	76	71	67	63	60	58	55	53	52	50	49	47	46	45	44	43	42	41	40	39	38	38	37	37	36	35	35	34	34	33
4.5	212	150	122	106	95	87	80	75	71	67	64	61	59	57	55	53	52	50	49	47	46	45	44	43	42	42	41	41	40	39	38	38	37	36	36	35
5		158	129	112	100	91	85	79	75	71	67	65	62	60	58	56	54	53	51	50	49	48	47	46	45	44	43	42	41	41	40	40	39	38	38	37
5.5		166	135	117	105	96	89	83	78	74	71	68	65	63	61	59	57	55	54	52	51	50	49	48	47	46	45	44	44	43	42	41	41	40	40	39
6		173	141	122	110	100	93	87	82	77	74	71	68	65	63	61	59	58	56	55	53	52	51	50	49	48	47	46	45	45	44	43	43	42	41	41
6.5		180	147	127	114	104	96	90	85	81	77	74	71	68	66	64	62	60	59	57	56	54	53	52	51	50	49	48	47	47	46	45	44	44	43	42
7		187	153	132	118	108	100	94	88	84	80	76	73	71	68	66	64	62	61	59	58	56	55	54	53	52	51	50	49	48	48	47	46	45	45	44
7.5		193	158	137	122	112	103	97	91	87	83	79	76	73	71	68	66	65	63	61	60	58	57	56	55	54	53	52	51	50	49	48	48	47	46	45
8		200	163	141	126	116	107	100	94	89	85	82	78	76	73	71	69	67	65	63	62	60	59	58	57	55	54	54	53	52	51	50	49	49	48	47
8.5		206	168	146	130	119	110	103	97	92	88	84	81	78	75	73	71	69	67	65	64	62	61	60	58	57	56	55	54	53	52	52	51	50	49	49
9			173	150	134	122	113	106	100	95	90	87	83	80	78	75	73	71	69	67	65	64	63	61	60	59	58	57	56	55	54	53	52	51	51	50
9.5			178	154	138	126	117	109	103	97	93	89	86	83	80	77	75	73	71	69	67	66	64	63	62	60	59	58	57	56	55	54	54	53	52	51
10			183	158	141	129	119	112	106	100	95	91	88	85	82	79	77	75	73	71	69	67	66	65	63	62	61	60	59	58	57	56	55	54	53	53
10.5			187	162	145	132	122	115	109	102	98	94	90	88	84	81	79	76	75	73	71	69	68	66	65	64	62	61	60	59	58	57	56	55	55	54
11			192	166	148	135	125	117	112	105	100	96	92	89	86	83	80	78	76	74	72	71	69	68	66	65	64	63	62	61	60	59	58	57	56	55
11.5			196	169	152	138	128	120	115	107	102	98	94	91	88	85	82	80	78	76	74	72	71	69	68	66	65	64	63	62	61	60	59	58	57	57
12			200	173	155	141	131	122	117	110	104	100	96	93	89	87	84	82	79	77	76	74	72	71	69	68	67	65	64	63	62	61	60	59	59	58
12.5			204	177	158	144	134	125	118	112	107	102	98	94	91	88	86	83	81	79	77	75	74	72	71	70	68	67	66	65	64	63	62	61	60	59
13				180	161	148	136	127	120	114	109	104	100	96	93	90	87	85	83	81	79	77	75	74	72	71	69	68	67	66	65	64	63	62	61	60
13.5				184	164	150	139	130	121	116	111	106	102	98	95	92	89	87	84	82	80	78	77	75	73	72	71	70	68	67	66	65	64	63	62	61
14				187	167	153	141	132	125	118	113	108	104	100	97	94	91	88	86	84	82	80	78	77	75	73	72	71	69	68	67	66	65	64	63	62
14.5				190	170	155	144	135	127	120	115	110	106	102	98	95	92	90	87	85	83	81	79	78	76	75	73	72	71	70	68	67	66	65	64	63
15				194	173	158	146	137	129	122	117	112	108	104	100	97	94	91	89	87	85	83	81	79	77	76	74	73	72	71	70	68	67	66	65	65

SPEED IN MILES PER HOUR

A-E-R-O-N-I-T-I-S

Dimmed His Lamps

"You say the glare of his headlight confused you. Weren't his lamps dimmed?"

"They were after I got through with him," said the man who had the narrow escape. "I gave him such a nice pair of black eyes that he could hardly see out of them."

—*Boston Transcript.*

The Reason Why

The sailor getting his hair cut noticed that Jerry, the Captain's dog, was lying on the deck beside the chair, and had his eyes fixed on John, the barber, who was at work. "Nice dog, that," said the sailor.

"You bet he is," said John.

"He seems very fond of watching you cut hair."

"It ain't that," said John. "You see, sometimes I make a mistake and snip off a little bit of a customer's ear."

Jimmie—"Say, Top, was that hair tonic you had in that bottle?"

Johnny—"No, that was mucilage."

Jimmie—"Then it is no darn wonder I can't get my hat off."

Phew!

He stood on the banks of the leaping brook,
His senses nearly reeling;
And now and then he would venture a look—
The village belles were peeling!—*Punch Bowl.*

See the Pilots swiftly winging,
Soaring upward to the sky,
White winged planes through cloudland swinging,
Swifter than the swallows fly.

When the morning light is breaking,
Bird men soar away with mails,
Mammoth planes the skyway taking,
With their loads of costly bales.
Unobstructed is the skyway,
Pilots spurn the earth and sea,
E'en the smoothest, broadest highway,
Is not so untrammeled, free.

Bird men over all the nation,
Dropping down from purple skies,
Gliding to their destination,
As the daylight fades and dies.

Oft' I gaze with rapture burning,
On the soaring planes on high,
As I wait intensely yearning
For the day when I shall Fly!

Paul Xavier.

"Come indoors immediately," called the nurse to a small boy whose father was going out. "You won't go to heaven if you are so naughty."

"I don't want to go to heaven," was his grievous reply; "I want to go with father."

Just a Sucker

She: "I met a fellow last night that was a regular cavalier."

Sailor: "What's a cavalier?"

She: "A handsome young man who takes a young lady to the theater, takes her to dine, brings her back in a taxi, and sees her to the gate, and says goodnight, without even asking her for a kiss."

Sailor: "We don't call them cavaliers."

She: "No? What do you call them?"

Sailor: "Just plain SUCKERS!"

In the Air

By Contact

Up, up to the sapphire sky,
Climbing, climbing as I go,
Up to where my dreams all lie,
Far from Mother Earth below.

Leaving man and earth behind,
In my faithful silver bird.
Up, with the aspiring wind,
From the earth scarce are we heard.

In the air, how can it seem
To wing your way on high?
Ah, 'tis almost a dream—
To race across the sky.

The towns and woods seem small,
The hills and streams yet smaller still,
And the earth: it hardly moves at all,
As the motor roars on with a will.

The clouds: they are never the same.
Some have a softer hue,
Than my faithful silver plane,
Cruising this sea of mystic blue.
And the wings, those man-made wings,
Which weather the wind and storm.
And each wire in turn sings,
As onward I am borne.

Up into the sapphire sky,
Flying, flying as I go
Here is where my dreams all lie,
Far from Mother Earth below.

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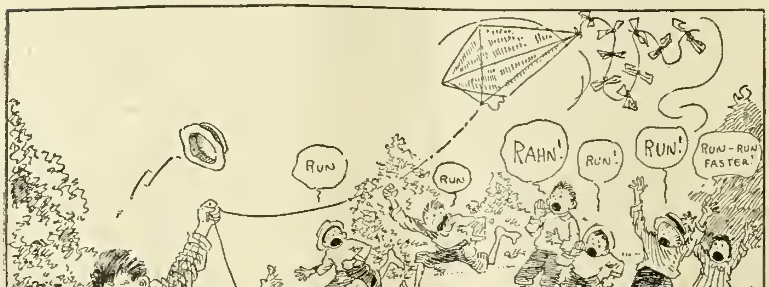
RUN
RUN
RAHN!
RUN!
RUN!
RUN-RUN FASTER!
TRIALS OF EARLY AVIATION ('TWAS EVER THUS)
BRIGGS

HARDIN PARACHUTE

Phoebe J. Fairgraves
918 Fuller Ave., St. Paul, Minn.

Holder of World's altitude record for women parachute jumpers, 15,200 feet

Date: July 10, 1921.
Type of ship used: Curtiss Oriole.
Curtiss Field, St. Paul, Minn.
Pilot: V. C. Omile.
20 minutes to reach ground after leaving ship.

HARDIN PARACHUTE USED.

Miss Fairgraves says of her experience:

> "At 15,200 feet it was terribly cold, about 10 degrees below zero, and it took all the courage that I could muster to step from the cockpit and pull the release cord. I was expecting a long drop on account of the height and the lightness of the atmosphere but the parachute opened as soon as I left the ship. When nearing the ground I was headed for some high tension wires but a pull on one side of the chute and I slipped away from the wires without any trouble."

At the Red Oak, Iowa, Meet, June 25, 1921, Paul Duncan, of North Platte, Neb., won a silver loving cup for spot landing with a Hardin Parachute, landing within a short distance of the spot from an altitude of 2300 feet.

In addition to our life pack we manufacture exhibition chutes in single, double and triple drops. Write for catalog and new price list.

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Engines having less than 75 hrs. flying time **$800.00**

Engines having over 75 hrs. flying time **$600.00**

The following engines are located at the NAVAL AIRCRAFT FACTORY, NAVY YARD, PHILADELPHIA, PA.

CURTISS OXX-6 100 H.P. MOTORS

These motors will be divided and offered for sale in the following general classes:

A.—Fair condition, 200 hrs. flying time **$345.00**

B.—With approximately 300 hrs. flying time **$260.00**

C.—In need of overhaul, possibly with some parts missing. Fine for instruction **$125.00**

New and unused CURTISS OXX-6 MOTORS can be used for motor and speed boats. These motors new cost $1,725.00. The sale price set on them. **$863.00**

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These motors have also been divided into classes and will be offered as follows:

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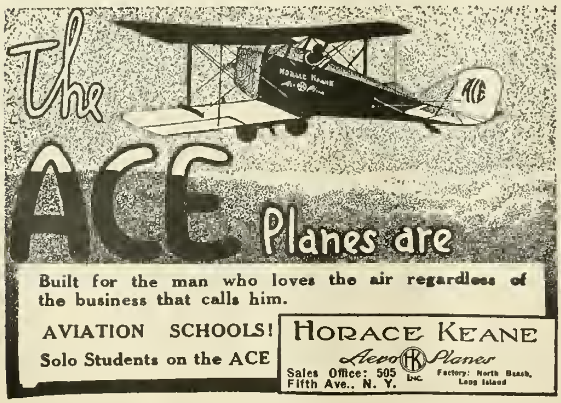

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Right Upper Uncovered Wings (some new, all perfect)	$60.00
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Rudders or Elevators (uncovered)	$5.00
New Pistons—OX-5	5.00
Axles	5.00
Landing Gear—Vees or Peachbaskets, per pair.	6.00
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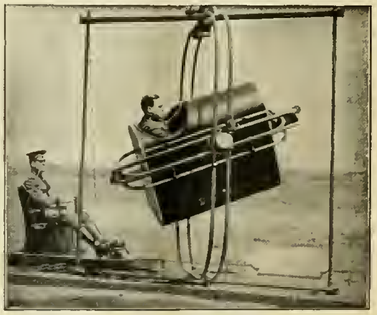

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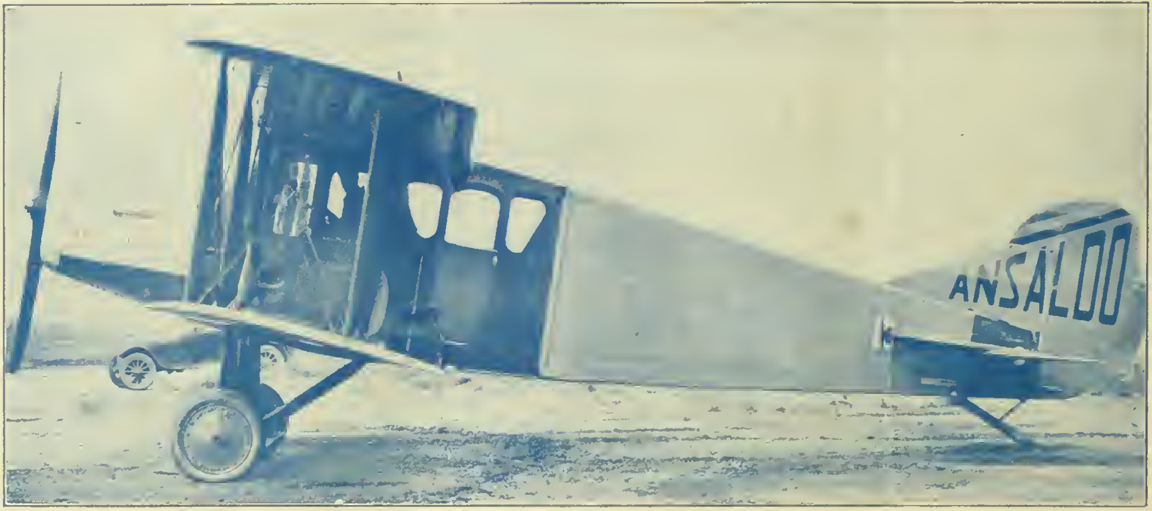

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Aeroplane Carriers — Aeronautics in German Universities

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TABLE OF CONTENTS

Aeronautics in German Universities 535
Aeroplane Carriers 535
The Right Man.................. 535
The News of the Week............ 536
The Aircraft Trade Review....... 538
Experimental Re-inforced Plywood Ribs 539
Instruction to Pilots for the Use of Mixture Controls 541
Velocity Determination in McCook Field Wind Tunnel 542
Deflection of Beams of Non-Uniform Section 543
Naval and Military Aeronautics.... 547
Foreign News 548
Elementary Aeronautics and Model Notes 549
Aeronitis 550

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Aeronautics in German Universities

GERMANY is proverbially thorough in all she does, and there are strong indications that this characteristic is to be applied to the future of aeronautics. Keen interest is being taken in the subject, and it seems to be realized that in order to develop properly it is essential that the scientific side, as well as the practical, must receive close attention. An important memorandum dealing with the subject of aeronautical instruction at the Universities has recently been worked out by the Committee for University Questions of the Hanover Technical College, and contains a number of important suggestions which, it is submitted, must be carried out if German aviation is to be developed on a similar scale. It suggests:—

That a chair of aeronautics and aircraft construction be introduced as soon as possible at at least one Prussian technical college.

That these chairs be equipped with laboratories and practice installations, and, by means of adequate assistance from the State, be placed in a position to guarantee a thorough experimental and, where necessary, also a practical training for the aeronautical engineers of the future.

That the existing institutions for instructional and research purposes be developed, and in the event of their being united with a chair, that a special current grant be made.

That relation with the research and test laboratories outside the university be furthered by means of State grants, so that the museums and installations may be utilized in the university course.

That, above all, aviation should take its rightful place in university and continuation courses for engineers and teachers, and be included in the normal curriculum (applied physics, etc.) more than hitherto.

All of these suggestions are admirable, and are well worthy the close attention of our own University authorities.

Aeroplane Carriers

ONE lesson that all observers have read in the Ostfriesland bombing tests is that the navy needs aeroplane carriers. An old vessel of one of the subsidiary classes is being refitted to carry planes. But it is neither large enough nor fast enough for such service.

Secretary Denby says that he will recommend to Congress an appropriation of $25,000,000 for the construction of two up-to-date aeroplane carriers. Unfortunately, the department didn't exert its influence sufficiently when the naval appropriation bill was up to strengthen the third or air arm of the navy. It apparently preferred that $90,000,000 should go for capital ships. It is true that the Senate amended the House bill by making provision for two aeroplane carriers. But the Senate also increased the total carried in the bill from $396,000,000 to $494,000,000. That wasn't the way to get carriers authorized.

The House was determined that not more than $400,000,000 should be spent on the navy in 1921-'22. The Treasury's necessities made it inadvisable to spend more than that. But the House was too strongly bent on completing the 1916 building program. It might have dropped out one or two battleships. It didn't, however. So when the Senate added the two aeroplane carriers it made the tactical error of not substituting them for other capital ships on the construction list. That would have forced a clear issue on which the Senate was right and the House was wrong. By adding $98,000,000 to the naval bill total it forced an issue on which it was wrong and the House was right.

The bombing tests didn't develop anything very surprising, except to the ultra-conservatives, who have been so influential in shaping our naval policy. It was evident a year ago that we ought to build plane carriers. If Secretary Denby now asks Congress to order them built he can easily carry his point if at the same time he recommends the diversion to their construction of some of the money now allotted to superfluous battleships.—Editorial in N. Y. *Tribune.*

The Right Man

THE Society of Automotive Engineers is to be complimented upon being able to secure so excellent a man as Dr. H. C. Dickinson of the Bureau of Standards to act as manager of its new research department. There are few men with such a fund of information or so keen an appreciation of the value of research, and especially of fundamentals upon which all sound research work must be based.

THE NEWS OF THE WEEK

Army Planes to Bomb Another Battleship

Washington.—An independent bombing enterprise against naval craft is being planned by the Army Air Service. With the old battleship Alabama as a target and using missiles up to 4,000 pounds in weight, the army flyers hope to add a new chapter to the interservice controversy which recently resulted in destruction from the air of several former German war vessels.

The Alabama was selected for the victim following request of the army for a target ship. Acting Secretary Roosevelt has announced that the Navy Department is dismantling the vessel and will be ready to turn her over to the land and air warriors about September 1.

With the event exclusively an army affair, it was said efforts would be made to simulate battle conditions when the Alabama comes under fire. For that purpose the army asked that the ship be turned over in sea-going shape, absolutely watertight, bulkheads sound, steam in her boilers and ventilating and communicating systems in working order. Request also has been made that her magazines be filled with full loads of powder and that in all respects except her useful offensive armament, which is being salvaged, she be ready for action.

It was said that a definite reply from the navy as to the extent to which the Alabama would meet these conditions when turned over had not been received, nor were the army men hopeful that they could obtain radio control equipment for her similar to that successfully employed on the battleship Iowa during the recent bomb tests. It is hoped, however, to have the ship in motion, probably under tow, when the army airmen open their attack.

Army plans call for all phases of air attacks at sea. Everything from the 300-pound bombs similar to the first rained on the German dreadnought Ostfriesland to missiles double the size of the 2,000 pounders which sent her down will be employed, it was said, and in addition smoke and gas bombs will be hurled at her decks from above. Several new projects of the Chemical Warfare Service are to be tested out against the Alabama, and penetrative qualities of the gases will be measured by means of the ventilation system of the ship.

The Air Service also plans to attack the Alabama with torpedo planes. In this phase naval airmen may be asked to participate, it was said, as army development of the air torpedoes is not regarded as fully satisfactory.

The Alabama is a much older ship than was the Ostfriesland, but protected by armor varying from 16½ to 9 inches in thickness, as against 11¾ to 6¾ on the German craft. The protective decks are about the same.

Air Meet in Colorado

Colorado's first aero meet was held by the Colorado Aero Club July 30, 31st, August 1st and 2nd on the Curtiss-Humphreys field at Denver. It was a distinct success. The meet was originally to have been terminated on August 1st, but owing to the large program and the enthusiasm displayed by both the entrants and the spectators, the fourth day was added. The attendance for the entire meet was close to three hundred thousand. There were presented eight cups and $2,500 in cash prizes.

The tone of the meet throughout was safety. Stunting, when performed, usually prevailed at a safe altitude. The officials of the Colorado Club and The Aerial Navigation & Engineering Company have in this way done a great deal for the aviation industry.

The planes attending represented almost every type manufactured in America. The Laird Swallow, piloted by "Buck" Weaver, proved to be the most popular ship on the drome. The performance of this plane was indeed a revelation to the citizens of the "City a Mile High."

A banquet was held at the Brown Palace Hotel on August 1st. Mr. C. A. Johnson, president of the Colorado Aero Club, presided. The addresses were made by Jerry Vasconcelles, N. H. Steele, Don Hogan, Captain Underwood, Harry Ruffner and Al Lendrum.

Navy Blimp on Joy Ride

The H-1, the Navy Air Service smallest blimp, went on a rampage from the air station at Rockaway Park, L. I., catapulted the pilot and crew of two into a Barren Island swamp when they attempted to bring it to earth, and, after drifting at a height of 5,000 feet for more than three hours, ended an unpiloted journey of fifty miles by landing gracefully on a farm near Scarsdale, N. Y.

Lieutenant Charles Bauch, test pilot; Machinist E. A. Sullivan and Chief Aviation Rigger D. A. Kenny floundered in the mud, bruised and cut by their precipitate fall, and were later taken to the Air Station hospital, where it was said that their injuries were not serious.

Lieutenant M. S. Eddy in a plane and enlisted men in motor trucks pursued the unruly blimp to its landing place. A good part of the population of Scarsdale, attracted by the sight of the balloon cavorting mysteriously over their city, raced after it as they saw it suddenly begin a graceful descent. After narrowly missing a church steeple and a couple of flagpoles in its descent, the H-1 finally settled down to earth without a jar. As the runaway touched the field a score of men made her fast with ropes to a tree and waited the arrival of the navy rescuers.

Wright Corporation Declares Dividend

The directors of the Wright Aeronautical Corporation at their meeting declared an initial dividend of 25 cents a share on the 224,390 shares of capital stock now outstanding. It is presumed that with a continuance of its present earnings the stock will be put on a regular annual dividend basis of $1 a share.

The report of the company for 1920 showed net earnings after all deductions of $411,349, equal to $1.88 a share on the stock. The gross sales were $1,486,000. It is stated that the company at the present time has $3,000,000 in orders on its books, mainly for Government account, or double the amount turned out in 1920 and equal to one year's capacity.

Rolfe with Cuban Company

Monte Rolfe, well-known American pilot, is now chief pilot for the Cuban-American Aerial Transportation Co. The company is operating two Farman Goliaths and one three-passenger Farman and very many natives are taking advantage of the opportunity to make flights.

In the flying school operated by the company Curtiss JN's and Canadian Curtiss are used exclusively. All of the original French personnel of the company have been replaced by Americans.

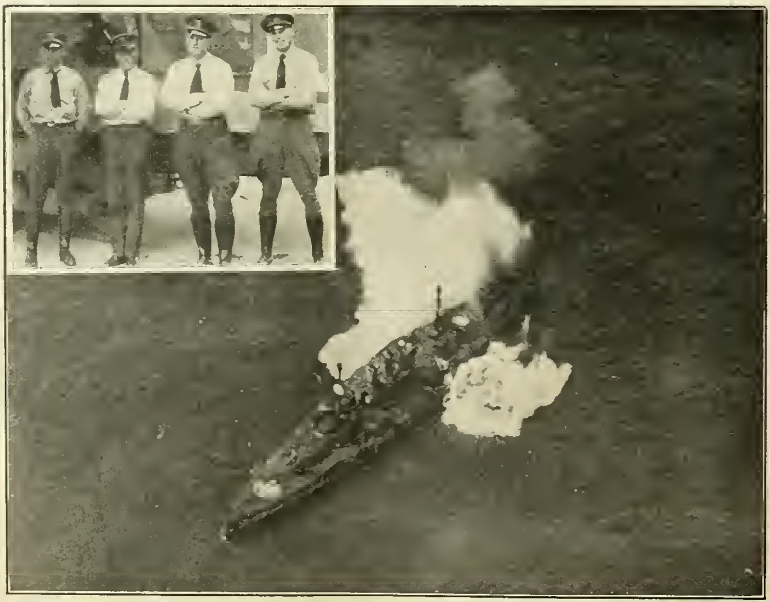


Photo U. S. Naval Air Service

Tbe full force of nine bombs dropped by Naval Aviators comprising Fourth Division caused former German battleship Ausfriedland to sink. Insert: Fourth division (left to right) Lieut. D. H. Musk, Lieut. J. M. Sheehan, Lieut.-Commander J. H. Stoney and Lieut. M. F. Eddy

ZR-2 to Start on Trans-Atlantic Trip August 25

Washington—The American Navy's great new rigid airship, the ZR-2, just completed in England, will start its maiden flight across the Atlantic to the United States on August 25, according to an announcement at the Navy Department August 4. Under the guidance of Commander L. H. Maxfield, who will be in command of the twelve officers and thirty men of the navy in her crew, the huge dirigible will leave Howden, England, and head out to sea on the second aerial Europe to America trip in history, and land in Lakehurst, N. J., flying low to conserve gas and ballast.

The officers on this flight were announced as follows: Commanding officer, Commander L. H. Maxfield of St. Paul, Minn.; executive officer, Lieut. Commander E. W. Coil of Tucson, Ariz.; senior engineer officer, Lieut. Commander V. N. Bieg of Bryn Mawr, Pa.; navigator, Lieutenant R. G. Pennoyer of Berkeley, Cal.; watch officer, Lieutenant H. W. Hoyt; watch officer, Lieutenant J. B. Lawrence, U. S. N. R. F.; radio officer, Lieutenant M. H. Esterly, U. S. N. R. F.; meteorological officer, Lieutenant J. B. Anderson, U. S. N. R. F.; assistant engineer officer, Chief Machinist S. S. Haliburton; special duty, Lieutenant C. A. Tinker, U. S. N. R. F.

In July, 1919, it took the British airship, the R-34, 108 hours and 12 minutes to reach Hazelhurst Field, New York, from East Fortune, Scotland. The ZR-2, which is faster than the R-34, should make the trip in less time, provided the westerly winds are not too strong.

The ZR-2, the largest rigid airship yet constructed in any country, has a gas-containing capacity 300,000 cubic feet larger than that of the ex-German airship L-71, which was surrendered to Great Britain. The main dimensions and characteristics of the ZR-2 are as follows: Length, 695 feet; diameter, 85 feet 4 inches; capacity, 2,700,000 cubic feet; total lift under normal conditions, 86 tons; total horsepower, 2,100; engines, 6 sunbeam "Cossack"; normal crew (officers and men), 28 to 30.

Ostergaard Enlarges

The Ostergaard Aircraft Works have moved to new and larger quarters at 4269 North Narraganset Avenue, Chicago. B. J. Ostergaard reports business brisk.

Aeronautical Course at the University of Detroit

Feeling confident that Detroit will eventually become an aircraft and an aircraft equipment center and that the demand for men trained in aerial science will become greater as time goes on, the University of Detroit is formulating plans for the establishment of a 5-year course in aeronautics. Commenting on this latest innovation of the University of Detroit, Mr. F. W. Hersey in an article in the *Michigan Manufacturer and Financial Record,* raises the question as to whether or not it is possible to do the subject justice in that length of time. He feels, however, that the University of Detroit can produce aeronautical engineers of a caliber superior to any now known, judging by present standards of the University, adding that like medicine, law, chemistry, and the multitude of other sciences, theory in aeronautics is one thing and practice is quite another.

In the opinion of Lieut. Thomas F. Dunn, dean of the new Department of Aeronautics at the University, who was interviewed on the new course, there are two ways of getting an aeronautical education, one to go up in the air and gather some experience, and, if spared for future investigation, return to solid earth and tackle the theory. The other way is to tackle the theory first and then try it out on the air. To convey an idea as to the latitude of this course, the subjects to be taught in the aeronautical course are given, as follows: Higher mathematics, communication, mapping, astronomy, physics, meteorology, weather calculations, theory of flight, balloons, aerodynamics, aerostatics, aircraft mechanics, testing drawing, administration, chemistry, electricity, engineering principles, metal working, working design and construction, topography, wireless telephony and telegraphy, safety devices, uses of instruments, some commercial law, and all there is or will be on aerial navigation laws, principles of law as it will be applied to the air, and aerial photography.

Fokker May Locate in Hartford

There is a possibility that if the Netherlands Aircraft Corporation decides to establish an American factory for the manufacture of Fokker planes it will be located at Hartford, Conn.

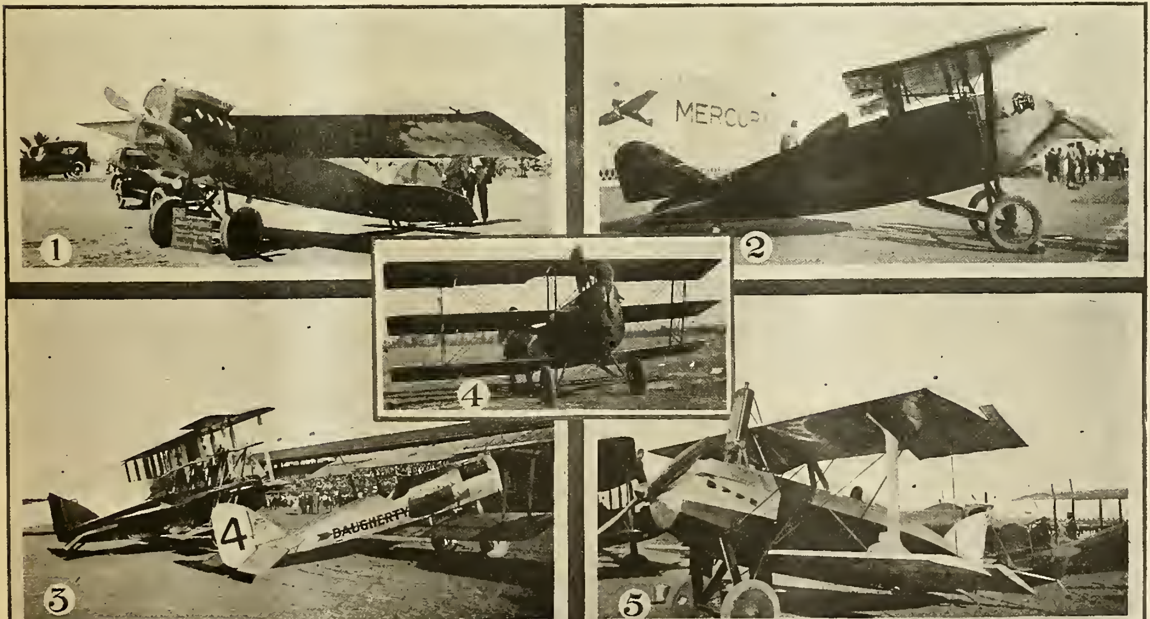
On Saturday (August 6) one of the six passenger Fokkers, piloted by Bert Acosta, visited Hartford and the passengers were greeted at Brainard Field, the municipal aviation center, by members of the Hartford aviation commission.

Robert B. C. Noorduyn and Fritz Cremer, the Fokker representatives in this country, visited the West Armory of the Colt's Patent Fire Arms Mfg. Co. plant, which was used during the war for the manufacture of the famous Browning guns. President Samuel Stone of the Colt Company is interested in aviation and the members of the Hartford commission and the Connecticut Chamber of Commerce would both encourage the location of an aircraft manufacturing company at Hartford.

The Fokker representatives were much impressed with the interest shown in aviation at Hartford. If the Fokker makers or some other aircraft company decides to locate in that city, a large section of the Colt plant is available, and is only a few hundred yards from the municipal field, which could be used for testing purposes.

A second Fokker plane, one of the three place express models, visited Hartford last week, arriving a few hours after the large plane, which remained until late Sunday afternoon.

Several members of the Hartford commission who went aloft in the big Fokker plane, were much impressed with its performance.



Some of the entries in the National Air Tournament at Los Angeles. 1. The Pacific Standard C1 monoplane; 2. The Mercury Gosline; 3. The Polson Special, Catron and Fish triplane and Daugherty biplane; 4 Catron and Fish triplane; 5 Catron and Fish special biplane

The AIRCRAFT TRADE REVIEW

Williams-Hill Report Sales

In a recent communication Errett Williams, president of the Williams-Hill Airplane Co., Arkansas City, Kans., reports that his company has disposed of thirty-eight planes this year and that they have prospects for the disposal of forty more. All of the sales have been the result of straight and sane passenger carrying and the practical demonstration of the utility of aerial transportation in Kansas, Missouri and Oklahoma.

Aeronautic activities in Kansas have been put on a sound foundation by the passing of a state law which makes it possible for every city of over 3,000 population to own and maintain a municipal landing field at the city's expense. The State Aircraft Board is composed of the Adjutant-General as chairman, A. K. Longren of Topeka as inspector and Errett Williams whose duty it is to issue licenses to qualified pilots in the state.

Arkansas City is thoroughly alive aeronautically and has two landing fields and twelve privately owned aeroplanes.

A. M. E. A. Convenes Oct 5

New York, July 26—The annual convention of the American Manufacturers Export Association, which numbers several automotive manufacturers among its membership, will be held at New York on October 5 and 6, and various matters of importance will be discussed.

Wright Aeronautical Publishes House Organ

The Wright Aeronautical Corporation of Paterson, N. J., has started a monthly publication for the benefit of its employees. In its leading article is set forth the aims of the publication, which are threefold: First, to create good feeling in the "Wright family"; second, to bring about co-operation between the various departments whose combined work builds the Wright aeronautical engine; and third, to bring every Wright Aeronautical employee in contact with the entire world question of aeronautics.

From Hispano-Suiza to Wright

In an article in the first issue of the monthly house organ of the Wright Aeronautical Corporation the following interesting facts are presented concerning the Americanization of the Hispano-Suiza motor:

"If almost any one of us would sit down and think, he would find that he knows some man or woman who, though born on foreign soils, came to these shores at an early age and who has been so imbued with the American spirit and so changed in mind and soul that they are no longer anything but American.

"The Hispano-Suiza motor is a mechanical analogy of such a person. At an age early in its aeronautical life we brought it to America and have so surrounded it with the atmosphere of American engineering ingenuity and so imbued it with that "be the best" spirit which is the all-pervading thought of American industry, that it is no longer the Hispano-Suiza, but a thoroughly American product, to which we have given the good old American name of Wright, in honor of the progenitors of all flight.

"The old saying that nothing in this world can remain stationary is particularly true in everything pertaining to aeronautics. An aeronautical engine must change constantly; must be improved to meet the varying demands placed upon it by plane designers and by the needs of the Army and Navy Air Services.

"The corporation was well aware of the criticism against the Hispano to the effect that the valves were delicate and set about the solution of this problem. To illustrate the results obtained by the change in cylinder construction, one Wright engine has been running at Carlstrom Field, in ordinary flight, for more than 400 hours without overhaul.

"More than fifteen major mechanical changes and improvements have been made in the 'Hisso' by the Wright engineers.

"The early French engines had very thin heads in the cylinder sleeves and considerable trouble was experienced with the valves. At first the Wright engineers thought the trouble was due to valve warpage, but careful study revealed that it was due to cylinder head warpage. The thickening of the cylinder head did away with the thin plate or diaphragm action of the thin head and permitted expansion without warping. This elimination of warping assured the perfect seating of the valves.

"The valves themselves were also somewhat changed in design. The size of the neck was increased to allow a better heat flow away from the face of the valve, thus keeping it cooler and making it less likely to burn. The design of the cylinder block was changed to allow increased circulation of cooling water around the exhaust valve seats.

"The installation of American magnetos and an American ignition system was one of the first changes.

"The design of the pistons was altered completely. The piston pin was changed from the fixed to a floating type. The modified piston does not burn so easily, and is a better manufacturing job. The original Hispanos had a set screw which held the piston pin in place. This in service, due chiefly to the carelessness of mechanicians, was sometimes likely to drop out, often going through the head of the piston or through the bottom of the crank case. This permitted the piston pin to rub against the cylinder wall, scoring it and spoiling the motor until expensive repairs could be made. The floating type of piston pin, it has been found, gives better wear than the fixed type.

"Changes were also made in the connecting rod and bearing. The French inner connecting rod and bearing were integral with each other. This made the lightest possible construction, but defects were that the manufacture of these bearings were exceedingly difficult and their life in actual service very short even under the best conditions. The change to the Wright type gave a great increase in duration of this member, and also made a simpler manufacturing operation.

"A new carburetor for the Hisso was also developed. The new carburetor has many merits, but the most important is the more complete control of the mixture. This is especially useful in altitude work.

"Several changes were made in the magneto bracket until a modification was obtained which made it possible to use a straight engine bed in the plane, simplifying removal and replacement. A change in the vertical shaft which made for greater ease in manufacture and in timing was also made.

"The French design of the lower half of the crank case was for a wet sump meter, that is, one carrying its own oil in the lower half of the crank case. On steep dives or steep climbs this meant there was danger that the cylinders in front or in the rear would be flooded. The first American modification was to use an auxiliary oil pump placed on the rear of the magneto bracket to make the meter a dry sump job. This was found to be only a makeshift. A later design placed all oil pumps together in a compact unit, easily accessible and properly placed. An oil lead from the front end of the camshaft housing was run back down to the crank case to take care of overflow oil when the plane is diving, as well as to prevent the camshaft housing from inundation and possible leaking down the valve stems.

"A slight change was also made in the upper half of the crank case in order to give oil a direct lead to the front thrust bearing. This improvement permits unobstructed lubrication of the bearing, which is very heavily worked and is also a precaution against possible trouble from partial failure of splash lubrication. The rear end of the crank case was slightly changed to accommodate the magneto bracket, which is interchangeable on the 180 and 300.

"The design of the water pump attachment and outlet was slightly modified to make them more compact and accessible. A fuel pump for handling gasoline without the use of a pressure tank and air pump has been provided on the bottom of the new magneto bracket, and provision has been made for the installation on the magneto end of the engine of a standard type electric starter.

"But although the 'Americanized' engine is, in the opinion of many aeronautical experts besides those of the Wright Corporation, as near perfect as is possible in this year 1921, the work of altering, improving and amending is going ahead as steadily on the Wright motor as on the old 'Hisso' from which it developed."

Platt-Margeson Aircraft Co. Organized

The Platt-Margeson Aircraft Co. has been organized at Quincy, Mass., and will engage in commercial aviation.

The personnel of the company is as follows: A. F. Platt, formerly R.A.F.; C. L. Margeson, formerly R.A.F.; H. P. Pinkham, formerly U. S. Air Service; H. J. FitzGerald, formerly U. S. Air Service; M. E. Bumpus, formerly U. S. Air Service; Mrs. Ada C. Ross.

The flying field of the company is located at South Hingham, and arrangements are being made for the use of a field in North Carolina for winter flying.

EXPERIMENTAL REINFORCED PLYWOOD TRUSS RIBS

THE purpose of this report is to summarize the work that has been done on the development of reinforced plywood truss ribs, comparing this type of rib with other types, and drawing conclusions from the test results in regard to data to be used in further design work.

The problem primarily has been to develop large ribs that should possess the following characteristics:

1. Adequate strength.
2. Minimum weight.
3. Low production cost.
4. Simplicity of construction.
5. Rigidity.
6. Reliability.
7. Economy of material.

Considerable work had already been done on large ribs, notably by the Forest Products Laboratory, Barling, Glenn L. Martin Co., and Handley-Page.

The Forest Products Laboratory has for two years been working on the design of ribs with a 15-foot chord for the Navy Department. Their first ribs were of the plywood web type. Tests of these ribs "indicated that it would not be feasible to build a rib of this length (15 feet) having a plywood web because of the greater weight of the web required to obtain the desired strength." The laboratory then turned their attention to truss ribs, and up to May, 1919, had made and tested 11 different designs comprising six types, known as the wrapped veneer strap, the twisted veneer strap, modified Navy design, simple Pratt truss, Warren truss, and double Pratt truss. A summary of the results of tests on these ribs is given in Table I. Loading 1 is a triangular loading with the apex of the triangle 25 per cent of the chord back from the leading edge. Loading 2 is the loading for the high incidence condition. It is triangular with the apex of the triangle at the leading edge.

TABLE I

Strength Tests on 15-Foot Aeroplane Wing Ribs

Design No.	Type.	Load distribution.	Number of tests.	W = average weight of ribs, pounds.	P = average total load sustained, pounds.	Ratio P/w. W = average weight of ribs, ounces.
1	Wrapped veneer strap.	Loading 1	3	2.70	496	11.5
2	Do.	Do.	2	3.60	772	13.4
3	Do.	Do.	2	3.45	854	15.5
4	Twisted veneer strap.	Do.	5	3.16	447	8.8
5	Navy design (modified)	Do.	3	2.51	729	18.2
6	Pratt truss.	Do.	5	2.45	700	18.0
7	Warren truss.	Do.	3	3.63	850	14.5
8	Do.	Do.	3	2.97	748	15.7
9	Do.	Do.	3	2.90	849	18.3
10	Double Pratt truss.	Do.	3	2.96	606	12.8
11	Warren truss.	Do.	3	2.23	742	20.8
11	Do.	Loading 2	3	2.26	974	26.9

The conclusions of the laboratory regarding these various types are given below:

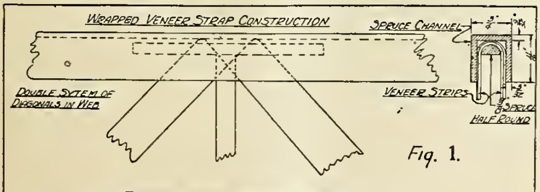

WRAPPED VENEER STRAP CONSTRUCTION
SPRUCE CHANNEL
DOUBLE SYTEM OF DIAGONALS IN WEB
VENEER STRIPS
3/8" SPRUCE HALF ROUND
3/4"
3/32"

Fig. 1.

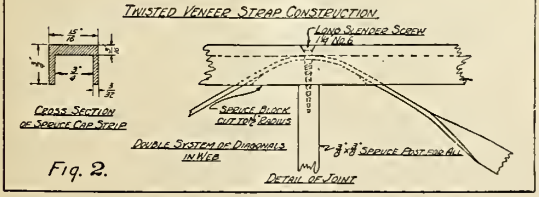

TWISTED VENEER STRAP CONSTRUCTION
LONG SLENDER SCREW 1 1/4 No.6
15/16"
3/4"
3/32
CROSS SECTION OF SPRUCE CAP STRIP
SPRUCE BLOCK CUT TO 1/2" RADIUS
DOUBLE SYSTEM OF DIAGONALS IN WEB
3/8"x3/8" SPRUCE POST FOR ALL
DETAIL OF JOINT

Fig. 2.

In the wrapped veneer strap construction, figure 1, the attempt was made to utilize the full tensile strength of veneer strips, the diagonal winding between continuous. Satisfactory strength was obtained upon the addition of channels over the cap strips, but the strength per unit weight of the rib, modified in this way, was below that of several other designs.

The twisted veneer strap rib, figure 2, failed repeatedly in the diagonal tension members where they are bent around small blocks in the channel cap strips. This weakness could probably have been remedied somewhat by steaming the strips before bending, but it did not seem probable that strength: weight ratios equal to those of some of the other designs could be obtained. The rib was also less stiff than ribs of several other designs.

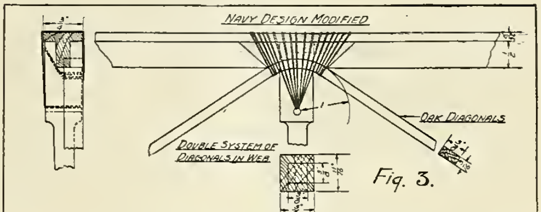


Fig. 3.

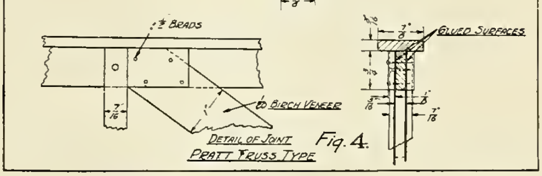


Fig. 4.

The Navy design of rib, figure 3, when modified, proved to be very light and also quite strong, but the time required in making it was much greater than that required in the preparation of other ribs equally light and strong.

The Pratt truss type, figure 4, gave very satisfactory strength per unit weight values. It was designed to develop the full tensile strength of wood by using thin strips of veneer for the diagonal members wide enough to provide adequate strength in the glued joint. Screws or nails contribute very little to the strength of joints of the type used in this rib, so that the glue must be depended upon for the strength of the rib. Ribs of this type will effectually sustain loads in one direction only.

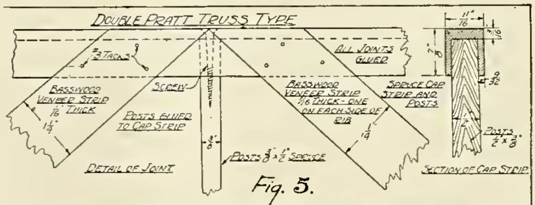


Fig. 5.

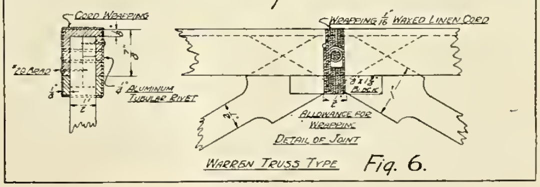


Fig. 6.

The double Pratt truss design, figure 5, was intended to overcome the objection of nonreversible loading. It, however, also depends upon glued joints for its strength. The strength per unit weight of this type of rib is not as high as that of the simple Pratt truss rib.

The best results with the Warren truss type of rib, figure 6, were obtained with the design in which all diagonals and cap strips were made of spruce. Ribs of this type may also be subjected to reversed loading. Considered from the point of view of maximum load per unit weight, the Warren truss rib was superior to any of the other types. It is relatively simple, and while it depends in part upon glued surfaces in the joints for strength, the lapped and taped construction of the joints gives it considerable strength, should the gluing prove to be poorly done.

Three truss ribs designed by Mr. Barling were recently tested by the materials section of McCook Field. The general construction of this rib is shown in figure 7. The chords were each made of a single piece of spruce cut to a T section, while the web members were similarly each of one piece of spruce of cruciform section. Each gusset plate is attached with from two to eight small brass screws, there being about 230 screws in the entire rib. The test data for these ribs are given in Table II. The chord length of the Barling ribs is 162 inches.

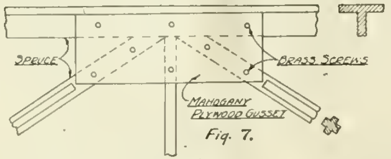


Fig. 7.
Barling Rib

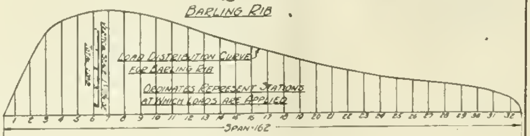


Fig. 8.

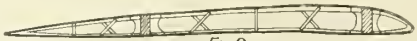


Fig. 9.
Glenn Martin Rib

TABLE II

Specimen.	Maximum load.	Weight in ounces.		Strength: weight ratio.		Center deflection.
		Original.	Final.	Original weight.	Final weight.	
						In.
1	915	34	31	26.9	29.5	0.36
2	1,115	34	31	32.8	35.9	.97
3	1,050	34	31	30.9	33.9	.45
Average	1,030	34	31	30.2	33.1	.59

These ribs showed a high strength: weight ratio. No failures occurred at the joints, which are the critical points with built-up ribs. The labor cost, however, on a rib of this type is very large owing to the great number of parts required and the difficulty of shaping so many of the members to the proper form. Furthermore, for this rib the type of loading, as shown in figure 8, was much less severe than the standard loading, except on the rear portion of the rib. Instead of applying all the loads to the bottom chord, which between the spars was in compression, only every third load was applied there and the others to the top chord, which was in tension between the spars. Since this system of loading considerably relieved the stresses, the values for the strength: weight ratio in Table II must be at least partially discounted.

The Forest Products Laboratory tested a number of commercial Handley-Page ribs and found them unsatisfactory. When modified to closely resemble the Forest Products Laboratory's simple Pratt truss rib, the Handley-Page rib was much improved. The best results on two of these modified ribs were as follows:

Weight.	Average load.	Strength: weight ratio.	Chord.
15 ounces	426	29	Probably 10 feet.

A triangular loading with the apex 25 per cent back was used. This rib was very light for its size but was of insufficient strength. It could not, moreover, sustain a reversed load and its strength is almost entirely dependent on the gluing.

The rib developed by the Glenn L. Martin Co. for use on the Martin bomber is a most remarkable rib. It was an outgrowth of the conventional plywood web type of rib with long rectangular cut-outs. The construction is shown in figure 9. The function of the X-web members is to carry shear. They are more effective in doing this than the verticals of the plywood web rib because all the grain of the X members is in the direction of the stress. Data from tests made at the Martin factory on this rib are given in Table III.

TABLE III

Weight.	Load.[1]	Strength. Weight.	Chord.
Ounce.	Pounds.		
10	436	43.6	94
12	615	51.2	94
12¼	451	36.8	94
11.4	501	43.9	94

[1] Loading triangular with apex of triangle 25 per cent back.

Ribs of this same design have been tested by the Forest Products Laboratory with the results given in Table III-a.

TABLE III-a

Number of ribs tested.	Weight.	Load.[2]	Strength. Weight.	Chord.	Deflection at maximum load.
	Ounces.	Pounds.			
Maximum	11.3	575	50.8	94	0.51
Minimum	11.7	447	38.3	94	.53
Average of 5	11.5	486	42.2	94	.53

[2] Theoretical high-speed loading.

The strength: weight ratio of these ribs is extremely high, but the great effect of the chord length on this ratio must be taken into account in comparing ribs with different chords. The law of variation for this ratio is not known, but it may be assumed approximately as the three-fourths power of the ratio of the chord lengths. The Martin ribs are simple to construct and are economical of material. They are admirably adapted for use on a wing with a comparatively light wing loading or a fairly close rib spacing. It is not believed that this type would be as satisfactory if a much greater strength were required. As the basic principle of the Martin rib construction is the same as that of the plywood web rib with long rectangular cut-outs, the fact that the latter type of rib proved unsatisfactory for a chord length of 15 feet would indicate that the Martin rib also would not be economical for chord lengths greater than 9 or 10 feet. Tests made at the Naval Aircraft factory on 15-foot ribs of the Martin type substantiate this conclusion.

Reinforced Plywood Truss Ribs

The principle involved in the design of ribs of this type is that by making the chord and web members integral, the difficulties experienced with built-up truss ribs in securing sufficient strength at the joints would be obviated. The manner in which this is done is illustrated by figure 10. One of the very important incidental features of such construction is the great saving in labor made possible by having web members of uniform section throughout their length, thus eliminating the careful fitting, gluing, and taping required in truss ribs of the

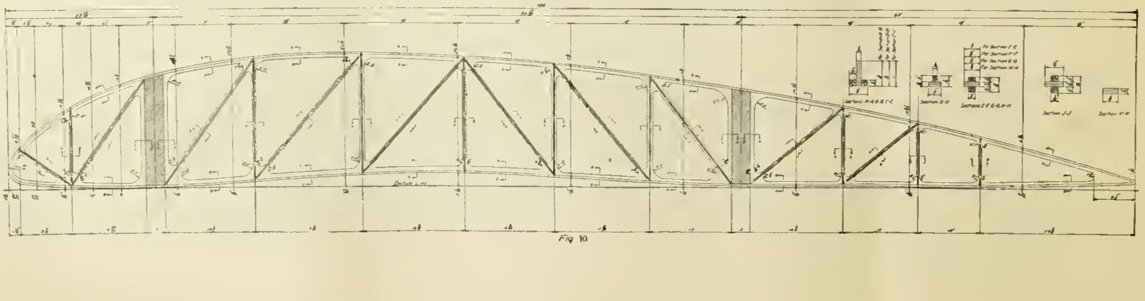


Fig 10

type shown in figure 6, and having the chords of a simple section. It will be observed that in most of the ribs so far discussed the chords members have been of a channel or T section, which is somewhat difficult to cut and which requires steaming to bend the portion at the nose.

The first ribs of this type to be designed had a chord length of 106 inches and were of the USA-18 wing section. In the design of these ribs, stress diagrams were made for the standard triangular loadings with the apex of the triangle at the leading edge, 25 per cent and 50 per cent back from the leading edge, and the most severe stresses used for each member. In addition to the direct stresses, the bending moments due to the test loads applied to the lower chord were computed, assuming the chord continuous beam between spars.

The design and test data on these ribs are given in Table IV.

Table IV

Rib.	Direction of grain of face plies.	Species of plywood.	Plywood thickness.	Rib weight.	Maximum load.[1]		Load. / Weight.	Maximum deflection at center.
					First.	Final.		
	°		*In.*	*Oz.*				*In.*
1	45	Birch-poplar	⅛	18	410	925	51.4	0.450
2	45	Do.	⅛	18	550	925	51.4	.500
3	45	Do.	⅛	17½	540	....	30.9	.300
4	0	Do.	⅛	19	[3]650	850	44.7	[2].285
5	0	Do.	⅛	17	[3]650	750	44.1	[2].285
6	0	Spruce-poplar	⅛	15½	620	620	40.0	.440
7	0	Do.	⅛	15	575	575	38.3	.550

[1] Triangular loading with apex at leading edge.
[2] Maximum deflection under 650-pound load.
[3] No failure.

In the ribs with the grain of the face plies at 45° the chords members were all weak in bending, and not until they were reinforced could the strength of the rib be developed. Although these ribs were stiffer than those with the grain of the face plies horizontal they proved unsatisfactory because of the weakness of the chords, and the high value of the strength: weight ratio should be discounted. Ribs 3, 4, 5, and 6 proved to be entirely satisfactory just as they were. In all these ribs failures occurred in one of two panels in the lower chord and none in the web members. As the strength above 600 pounds of a rib of this chord length cannot be utilized, the slightly less efficient ribs with spruce webs are the best because of their lower weight.

A test on a reinforced plywood truss rib of the USA-27 wing section with a 65-inch chord is of interest. This wing section, even with a comparatively short chord, is too deep between the spars to permit the effective use of a standard Spanish cedar plywood web with circular cut-outs. In the truss rib designed there were only four diagonal members in the 26-inch space between the spars. This resulted in long bays and hence rather heavy chords, but cut down the number of parts. The plywood used was 3/32-inch 3-ply spruce poplar with the grain of the face plies horizontal. All cap strips and reinforcing were 3/16 by 3/16 inch spruce. This rib weighed 9 ounces and sustained a load of 500 pounds. A strength of 350 pounds was the maximum required, but it was impracticable further to cut down the size of the members. It is suggested that a rib of the Glenn Martin type of rib construction for the web and chords between the spars would be superior for small, deep ribs to the truss construction here described, for the reason that a lower weight of rib could probably be obtained.

(To be continued)

INSTRUCTIONS TO PILOTS FOR THE USE OF MIXTURE CONTROLS

Purpose of the Mixture Control

Most modern aviation engines are equipped with a device for controlling the supply of fuel to the carburetor jets under varying conditions, particularly those of altitude. These devices are known variously as "altitude controls," "pilot's control valves," "fine adjustment valves," "mixture control valves," etc. The purpose of all these valves is the same (although the particular manner of accomplishing the results may be different), i. e., to adjust the fuel flow at any set throttle opening for the best operation of the engine. This is particularly important at increasing altitude since the horsepower decreases rapidly as the air grows less dense or "thinner," whereas the fuel flow through the jets does not diminish at the same rate. This means that carburetors which are adjusted to give a proper mixture at sea level will give an excessively rich mixture at 15,000 or 20,000 feet. Since all engines are designed to run on a certain quality of mixture, excessive richness always results in a drop in power, irregular operation, spark plug fouling, and a decided waste in fuel.

Benefits to be Derived From the Use of the Mixture Control

By proper adjustment of the gasoline-air mixture entering the engine, with the control valve provided for this purpose (if the control functions efficiently), it is possible to obtain higher aeroplane ceiling, regular operation of the engine, and, because of the saving in fuel, a marked increase in cruising range.

The extent of the benefits to be obtained on the average engine can be appreciated from the following figures which are indicative of the results that can be obtained with a good control:

On a certain aeroplane equipped with a Liberty engine and a good type of mixture control it was possible to obtain at the service ceiling a 200 r. p. m. increase in speed of the engine, an increase in ceiling of approximately 2,000 feet, together with a 40 per cent saving in fuel.

It should be understood that results of this character can not be obtained on all service aeroplane engines, but even if marked increase in engine speed is not obtained, very often a considerable saving in fuel is effected without the pilot's knowledge.

When to Adjust the Control

In general, the mixture control should be left in the full rich position on a climb, after a take-off, until 3,000 or 4,000 feet altitude have been reached, to avoid possible irregularity in engine operation. In the case of fast-climbing aeroplanes where the pilot is busy with instruments, etc., it is permissible to leave the control in the full rich position until an altitude of 5,000 or 6,000 feet is reached.

After the first adjustment, the control should again be readjusted on the climb every 2,000 or 2,500 feet increase in altitude.

As the ceiling of the aeroplane is approached, it will probably be found necessary to adjust the control at smaller changes in altitude, possibly every 1,000 feet.

On the glide, especially where a considerable descent is contemplated, the control should be adjusted to the full rich position.

On cross-country or durotion flights, irrespective of the oltitude, the mixture control should be adjusted just os soon as the cruising oltitude is ottoined. This is important, as the principal value of the control is as a *fuel saver*, as has already been noted.

How to Adjust the Control

The proper adjustment of the mixture control is not very difficult and should become fairly automatic with a little practice.

Before taking off, the pilot should make sure that his control is in the "full rich" position. Ordinarily, and in the more modern installations, this position is at the rear end of the control sector corresponding to the same position as is ordinarily closed throttle, retarded spark, etc. If there is some doubt as to which of the two positions is "full rich," this should be determined on the ground by moving the control successively to both ends of the sector. The "full rich" position should give regular "operation" and the greatest number of r.p.m. The "full lean" position should give the lowest r. p. m., and, on some engines, cause very irregular operation and possibly even stop the engine.

When the proper altitude is reached at which the first adjustment of the control should be made, the pilot should manipulate the mixture control as follows:

(*a*) Move the control *slowly* toward the full lean position. Watch the engine speed as this is done.[1] Keep moving the mixture control toward the full lean position until you observe that the engine speed begins to decrease. The point at which the engine is just about to drop its speed, but has not yet done so, is the ideal position of the control. Obviously this is the point at which the maximum horsepower is being obtained with the best fuel consumption. Beyond this point the engine speed drops because not enough fuel is reaching the jets, and operation under this condition may be actually wasteful of fuel.

(*b*) The pilot should note the position of his mixture control the moment that the r. p. m. has first shown a drop. It will now be necessary to move the control back toward the rich position a considerable distance on the sector until the engine has regained its original speed and regular operation. When this has been done the control should again be moved forward slowly and stopped just before the point on the sector is reached where a drop in engine r. p. m. was obtained on the first attempt.

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[1] A good pilot should do this by listening to the sound of the engine in addition to watching the tachometer, as the standard tachometers have a perceptible lag.

(*c*) Since the purpose of the control is to obtain the most horsepower with the lowest fuel consumption, it is obvious that if the control produces an increase in engine r. p. m. (which will not occur frequently except at the very highest altitudes) the control should be left at the leanest position at which the control gives the greatest engine speed.

At each change in altitude of approximately 2,000 or 2,500 feet, the mixture control should be readjusted, the general procedure followed for the first adjustment being repeated. Inexperienced pilots may at first have some difficulty in finding the ideal position for the control. In that event as many attempts as desired can be made at each altitude to find the proper adjustment.

Hints and Precautions

In adjusting the mixture control the following precautions must be observed:

(*a*) It is always permissible to move the control *quickly* from the lean to the rich position. It is *never* permissible to move the control quickly from the rich to the lean position. This should always be done with a gradual movement of the control.

(*b*) The fact that the control should be moved gradually from rich to lean does not imply, however, that it should be stopped a considerable distance before the point is reached to which it can be carried without a drop in speed. The control should always be moved to the limit consistent with maximum speed of the engine and regular operation.

(*c*) Under no circumstances must the control ever be set so lean that the engine back-fires, misses, or runs intermittently. With some special types of controls designed for very high altitudes, the control will stop the engine if moved too far to the lean position. This point very often comes at a surprisingly short distance after the point at which irregular operation first begins. It is, therefore, an additional reason why the control should be moved slowly and gradually when carried toward the lean position.

In view of the fact that some types of mixture controls are not very effective, neither a large drop in speed nor a marked change in operation will always be noticeable with the movement of such controls. The pilot should not jump to the conclusion, however, that the control is inoperative and that it is therefore unnecessary or useless to use it. As has been stated before, often when a control appears to be inoperative, a considerable saving in fuel is being effected without any exterior evidence as regards engine or aeroplane speed. It is, therefore, advisable always to operate with the control set as lean as possible, even though this may not cause a noticeable change in engine operation.

Important.—Before making a descent of any considerable distance, the control should always be moved to the full rich position.

In conclusion, the pilot is urged to use his control as much as possible, particularly where fuel saving is a feature, even though a little patience may be required to set the control for the best operation.

—*Air Service Information Circular.*

VELOCITY DETERMINATION IN McCOOK FIELD WIND TUNNEL

IN the records of tests made in the McCook Field wind tunnel it has been customary to give values of velocity in terms of "standard air"—that is to say, the velocity in a given test is such as will be produced on "standard air" by the pressure observed during the test.

"Standard air" is air at a temperature of 16° C. and a density of 0.0763, "G" being 32.2. This convention is proper because the density of the air cancels out when the air forces are computed in terms of the pressure causing flow, as shown below:

It might be desirable to explain how the lift coefficient is calculated, so that it will be apparent that the density does not enter into the calculation. Suppose that *h* represents the height of the water column corresponding to the velocity head at a velocity *V*; then if p/g represents the density of the air in slugs, $p/g \times v^2$ equals K_1h. If *p* represents the lift on the model, and *A* its area, and K_y the absolute lift coefficient, then

$$P = K_y = \frac{p}{g} A V^2, \text{ and } K_y = \frac{P}{\dfrac{pAV}{g}}^{2}$$

Substituting,

$$K_y = \frac{P}{AK_1 \times h}$$

It is evident that this last expression is independent of density, and as this equation is used in calculating the value of the lift coefficients in all cases, the density of the air in the tunnel does not affect the value of the lift coefficient.

Computation of velocity is as follows: For the graphs of this report, the usual wind-tunnel practice has been followed, where the density in the room rather than in the tunnel is used as a basis on which to figure velocity. This has been done for convenience in view of itself. The correction when applied does not change the value of the lift coefficient, but changes the corresponding value of the velocity.

The various charts reported in connection with the McCook Field wind-tunnel tests are then based upon values of the energy of the air stream rather than the actual velocity.

The determination of true velocity is dependent upon a knowledge of the temperature and density of the air flowing through the observation section. The temperature is calculated on the assumption that the expansion is adiabatic from the atmospheric pressure to the pressure corresponding to the dew point, and is polytropic below the latter pressure. A correct knowledge of throat temperature is, of course, essential; and it is necessary to develop a special method of thermometry for reading it. Present methods are inapplicable to its direct measurement, for a thermometer introduced into the air stream occasions more or less adiabatic compression of the air striking it, with consequent rise of temperature at the point of impact (see fig. 1). The most advantageous position for the thermometer is with the bulb downstream, where it is subject chiefly to skin friction rather than impact.

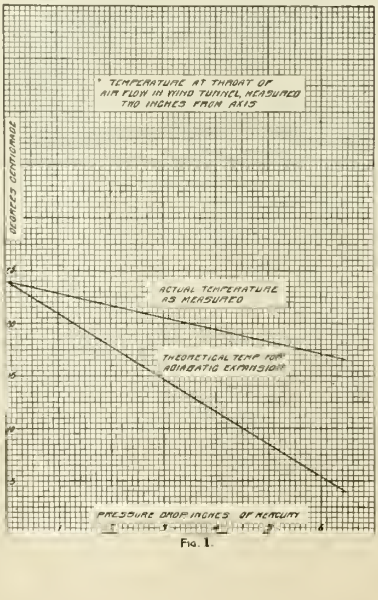


Fig. 1.

The assumption of adiabatic expansion in computing the temperature of the air is probably the best that can be made. We have no definite information as to the exponents in the case of assuming polytropic expansion. Liberation of heat of vaporization at the moment of condensation of the moisture contained in the air has a small theoretical effect on the thermodynamic action of the air. (For a treatment of the "Adiabatic changes of condition of moist air, and their determination by numerical and graphical methods" see "Smithsonian's Miscellaneous Collection," vol. 51, No. 4, 1910.)

As an example of the computation of actual velocity on the above assumption, refer to power run of March 7, 1919.

Barometer, 29.55" Hg.=2075/lbs./sq. ft.

Room temperature, 62° F.=521.6° absolute F.

Density, 0.0755 lbs./cu. ft.

Pressure in wind-tunnel throat, (—) 106.6 in. H_2O= 1,520 lbs./sq. ft.

	Miles per Hour
Actual velocity	525
Velocity in terms of standard air	465

DEFLECTION OF BEAMS OF NON-UNIFORM SECTION

THE purpose of this report is to explain and illustrate methods of calculating the deflection of beams of non-uniform section. The application of these methods to aeroplane analysis is given in article 173 of Structural Design and Analysis of Aeroplanes. All methods of computing the deflections of beams are based on the fundamental differential equation of the elastic curve of a beam under load:

$$\frac{d^2y}{dx^2} = \frac{M}{EI} \qquad (1)$$

Where—

x is measured along an axis tangent to the neutral axis of the beam,

y is measured along an axis perpendicular to the axis of x,

M is the bending moment acting on the beam,

E is the modulus of elasticity of the beam,

I is the moment of inertia of the beam.

The methods considered in this report are based on the special theorem developed from equation (1), that the deflection of any point in a beam, x, from a line tangent to the elastic curve of the beam at any point x_o, is equal to the moment of the area of the $\frac{M}{EI}$ curve of the beam between the two points, about x. The proof of equation (1) may be found on pages 130-134 of Boyd's Strength of Materials. The proof of the special case is on pages 153-156 of the same work.

The graphical and analytical methods shown in this report are logically identical, as both consist of computing the moment of portions of the $\frac{M}{EI}$ curve about points whose deflections are desired. It would be perfectly possible to make part of the computations analytically and a part graphically, and in some cases that is very desirable.

It should be thoroughly understood that the deflections obtained by these methods are deflections from a *tangent* to the elastic curve of the beam. This is not generally true of the deflection formulas found in the handbooks. The deflections found from the formulas are measured from a line passing through the supports, which line, in general, is not a tangent to the elastic curve. In such cases the deflection from the tangent must be modified in a manner to be explained in order to obtain the deflection from the line through the supports. In the case of a cantilever and of other beams so fixed that the elastic curve is horizontal over the supports no modification is necessary.

Graphical Method

The graphical method depends on the theorem generally used for finding graphically the moment of a number of coplanar forces about a point in that plane. The moment about any point of any number of coplaner forces is equal to the product of the intercept on a line through the point and parallel to the resultant of the forces, between the strings holding the resultant in equilibrium, the pole distance of the force polygon, and a factor depending on the scales of the force and funicular polygon (p. 343, Spofford's Theory of Structure). As all the forces in this work are vertical, the intercept in question will be on a vertical line through the point.

In order to illustrate the application of this method an example will be worked through. Assume a beam 210 inches long, supporting a load varying uniformly from 7 pounds per inch to 21 pounds per inch, as shown by the line *ab* in figure 1. Assume this beam to be supported 75 inches from the left end and at the right end. Assume the moment at the right-hand support to be zero. Assume the moment of inertia of the beam to vary as shown in figure 2.

The first step is to obtain the moment curve from the loading curve. To do this, divide the beam into any convenient number of sections. In this example the beam is divided into 14 sections, each 15 inches long. Any other number of sections could be used, and if desired they might be of unequal length. The reason for choosing 15 inches as the section length was that it gave a convenient number of sections and each section has a constant moment of inertia. Draw vertical lines through the centers of the sections. These lines will represent closely the lines of action of the resultant loads on each section. Draw the vertical line 0-14 in figure 3 and lay off on it 0-1, 1-2, 2-3, etc., proportional to the loads of sections 1, 2, 3, etc., in figure 1. Select any convenient pole distance, *P*, and draw the "rays" P-0, P-1, P-2, etc., completing the force polygon. Construct the funicular polygon, figue 4. From any point, *c*, on the line of action of force 1, draw "strings" parallel to P-0 and P-1 of figure 3. From the intersection of the string P1 parallel to ray P-1 and the line of action of force 2 draw a string P2 parallel to ray P-2. Continue until string P14 is drawn from the line of action of force 14 to the line of action of the right-hand reaction and parallel to ray P-14. Draw string PR from the intersection of P0 and the line of action of the left-hand reaction to the intersection of P0 and the line of action of the left-hand reaction to the intersection of P14 and the line of action of the right-hand reaction. Draw the ray P-R. In this discussion a ray is always a line in the force polygon, figure 3, and a string is a line in the funicular polygon, figure 4. Every string of the funicular polygon is parallel to the ray of force polygon with the same name. The magnitude of the left-hand reaction R_1 represented in figure 3 by R-0 and the right-hand reaction by 14-R. It is usually convenient to compute the values of R_1 and R_2 analytically as a check on the graphical work at this stage. In this case, taking moments about R_2,

$$R_1 \times 135 = 7 \times 210 \times 105 + 7 \times 210 \times 70 = 7 \times 210 \times 175.$$

$$R_1 = 1{,}905.5 \text{ pounds.}$$

$$R_2 = 14 \times 210 - 1{,}905.5 = 1{,}034.5.$$

By scaling from figure 3—

$$R_1 = 1{,}912 \text{ pounds.}$$

$$R_2 = 1{,}028 \text{ pounds.}$$

Error 6.5 pounds, or 1/50 inch.

This error is due in part at least to the fact that the line of action of the load on each section was assumed to be at the center of the section instead of slightly to the left of the center. This tends to make the value of R_1 too large. The funicular polygon of figure 4 is a bending moment diagram of the beam in figure 1 subjected to the 14 concentrated loads, one on each 15-inch section. It is evident that the bending moment curve for the uniform load is a curve inscribed in the polygon shown. The proof of this is as follows: Take the division point between any two sections, as point *d*, between sections 9 and 10. The forces to the right of *d* are 10, 11, 12, 13, 14, and R_2. They are represented in figure 3 by 9-14 and 14-R. This resultant is 9-R, which is held in equilibrium by the rays P-9 and P-R. In the funicular polygon *ef* is the intercept on a vertical line through *d*, between the strings P-9 and P-R, and is therefore a measure of the bending moment at *d*. In a similar manner the ordinate of the funicular polygon of figure 4 at any division point between sections can be shown to represent the bending moment at that point on the beam. It is therefore evident that if the divisions were made infinitesimal, the broken line P1-P2-P3, etc., would become a smooth curve inscribed in that line.

Figure 5 is the M/EI curve of the beam. The ordinates of this curve are the ordinates from figure 4 divided by a factor proportional to the moment of inertia at the same point, as shown in figure 2. The

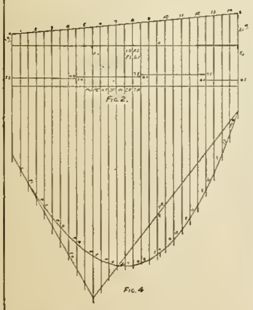


FIG. 2.

FIG. 4

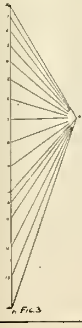


FIG. 3

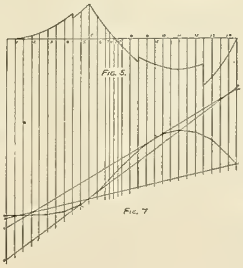


FIG. 5.

FIG. 7

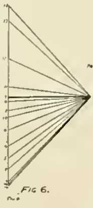


FIG. 6.

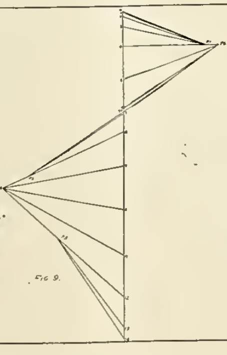


FIG. 9.

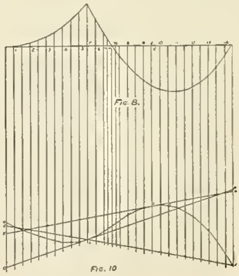


FIG. 8.

FIG. 10

ordinates from which the curve was plotted are those at the division points between the arbitrary sections into which the beam was divided for purposes of computation. The sudden breaks in the curve correspond to the sudden changes in the moment of inertia.

Figure 6 and figure 7 are developed from figure 5 in exactly the same manner that figure 3 and figure 4 were developed from figure 1. A smooth curve inscribed in the broken line *ghij* represents the elastic curve of the beam.

There are two modifications to this method which are illustrated in figures 8, 9, and 10. One of these modifications, shown in figure 9, is in the method of allowing for a change in sign of M/EI. In figure 6 areas 1 to *7a* are positive and are plotted from 0 down to *7a*. Areas *7b* to 14 are negative and are plotted from *7a* up to 14. All the rays are drawn from the same pole P. In figure 9 areas 1 to *7a* are also plotted downward from 0 to *7a* and rays are drawn from poles on the right-hand side of the line 0-14. The ray P_2–*7a* is prolonged to P_3, making P_2–*7a* equal to P_3–*7a*. The areas *7b* to 14 are also plotted downward, the rays being drawn from poles like P_3 on the left-hand side of 0-14. It is easily seen that a given ray has the same direction whichever way the force polygon is constructed. Suppose *7a–7b* in figure 9 had been laid off from *7a* up to *7b′*. To prove that P_2—*7b′* is parallel to P_3–*7b*. In the triangle P_2–*7a–7b′* and P_3–*7a–7b*, P_3–*7a* equals P_2–*7a*, *7a–7b* equals *7a–7b′*, and the angle P_3–*7a–7b* equals angle P_2–*7a–7b′*. Therefore P_3–*7b* and P_2–*7b′* are parallel, the alternate interior angles being equal, Q.E.D.

The second modification is in the method used to allow for the variation in I. In figure 5 the curve M/EI is plotted, while in figure 8 the curve of M is used. The ordinates of the curve of figure 8 are the same as those in figure 4. The only difference between figures 4 and 8 is that in the latter the base line is made horizontal for convenience. The areas of figure 8 are laid off as lengths in figure 9 exactly as figure 3 was constructed from figure 1. The pole distance, however, is varied in proportion to I. Thus the value of I for the first four sections of the beam is 50, so the rays P_1–0, P_1–1, P_1–2, P_1–3, and P_1–4 are drawn from a pole 50 units from the line 0-14. Between sections 4 and 5, I increases to 60, so the ray P_1–4 is extended to P_2, 60 units from 0-14 and the rays P_2–5 to P_2–8 are drawn from poles 60 units from 0–14. The pole was changed from P_2 on the right to P_3 on the left after drawing the ray P_2–*7a*–P_3 on account of the change in sign of M. In a similar manner the poles P_4 and P_5 are located 75 and 40 units, respectively, from 0–14 for the sections of the beam where the values of I are 75 and 40. The validity of the construction will be shown in the discussion of scales.

Proof

The proof that the curve *ghij* of figure 7 represents the elastic curve of the beam is as follows: Assume the number of sections into which the area of the M/EI curve, figure 5, is divided to be indefinitely increased. As the areas of the individual sections approach zero as a limit, the funicular polygon becomes a curve inscribed in the broken line *ghij*. Each tangent to this curve, as *klm*, will be the string of the funicular polygon between the lines of action of the differential areas of the M/EI curve on each side of the point of tangency and will be parallel to the rays of the force polygon holding in equilibrium the differential area at the point of tangency. In figure 7 as drawn with the beam divided into fourteen 15-inch sections, *klm* is the string between the lines of action of forces 9 and 10. These are not true forces as in figure 1, but rather areas of the M/EI curve called forces by analogy to the construction in figures 1 to 4. It is parallel to the ray P–9 of figure 6, which is determined by the total area of the M/EI curve up to the point *d*, figure 5, at the dividing line between sections 9 and 10. No matter how many sections the beam is divided into, the ray representing the total area up to any given point, such as *d*, will remain unchanged. The string *klm*, therefore, will continue to be the string from the line of action of the area to the left of *d*, to the area to the right of *d*, even when these areas are of differential size.

In figure 6 the area to the left of *d* is represented by 8–9 and is held in equilibrium by the rays P–8 and P–9. As this area approaches zero, the two rays holding it in equilibrium approach each other until they coincide. Thus the ray P–9 can be considered as two rays holding in equilibrium a differential force at 9, figure 6 representing a differential area at *d*, figure 5.

Consider any two tangents to the curve *ghij*, figure 7, as *klm* and *ohp*. These tangents are strings which hold in equilibrium the forces representing the area of the M/EI curve between *d* and *r*, figure 5. The intercept on any vertical line between the lines *klm* and *ohp* will be proportional to the moment of the area of the M/EI curve between *d* and *r*, about the point where the vertical in question intercepts the beam. The intercept on a vertical through one of the points of tangency will represent the moment of the area of the section of the M/EI curve about that end of the section. Whence, *in general*, the intercept of any vertical, between any tangent and the curve, represents the moment of the section of the M/EI curve between the point of tangency of the tangent and the vertical, about the point on the beam located by the vertical. Therefore, from the original treorem, the curve in figure 7 represents the elastic curve of the beam as the ordinate from any point on it to any tangent to it is proportional to the deflection of the point from that tangent.

In order to find the deflection from the tangent to the beam at any point it is necessary only to draw a tangent to the elastic curve in figure 7 at that point and multiply the ordinates from that tangent to the curve by the proper scale. The deflections from any other line can be similarly obtained by plotting the line in the proper position and measuring the ordinates from it to the curve. Thus, in a case similar to the one used for an example the deflection would probably be desired from a line passing through the two supports. The deflection will be proportional to the ordinates to the curve from a line, *shj*, drawn so as to intersect the curve at the points representing the supports. If the cantilever end were being considered by itself, the deflections would probably be desired from the line *ohp*, tangent to the elastic curve at the base of the cantilever. It should be remembered in plotting a reference line that a horizontal line will not in general appear on the funicular polygon as horizontal. Therefore, any reference line must be located by two known deflections or by the fact that it is tangent to the curve at a known point or the deflection at one point is known and also the fact that it is parallel to the tangent at some other point. This last case occurs in finding the deflection of an upper wing spar of an aeroplane like the Fokker D-7, where the deflections desired are those measured from a line cutting the curve at the cabane strut point and parallel to the tangent at the center line of the aeroplane. Fgures 8 and 10 are lettered in the same way as figures 5 and 7 and they may be referred to in the above proof with identical results.

Computation of Scales

One of the most important factors in the computation of deflections by this method is the computation of the correct scale. In figures 1 and 5, let 1 inch $= q$ inches for the linear scale. In figure 1, let 1 inch $= p$ pounds per inch run.

Then 1 square inch in figure 1 $= pq$ pounds.

For figure 3, let 1 inch $= n$ square inch from figure 1.

Then in figure 3, 1 inch $= n.p.q$ pounds.

If the pole distance in figure 3 is h inches, the scale of ordinates in the bending moment polygon, figure 4, is 1 inch $= npq^2h$ inch-pounds.

If the ordinates of the moment polygon are now divided by the ordinates to the moment of inertia curve, and the quotients plotted to a scale of 1 inch $= m$ inch of modified bending moment ordinates, the scale for figure 5 is 1 inch $=$ $mnpq^2h$ pounds per inches.^{3} Therefore, 1 square inch of figure 5 $= mnpq^3h$ pounds per inches.^{2}

For figure 6, let 1 inch $= r$ square inch from figure 5 $= rmnpq^3h$ pounds per inches.^{2} If the pole distance in figure 6 is h_1 inches, the scale of ordinates for figure 7 is 1 inch $= rmnpq^4hh_1$ pounds per inch. For deflections this should be divided by E, so the scale of deflection will be 1 inch $= rmnpq^4hh_1/E$ inches. In the example computation in this report—

$r = 0.5$.

$m = 0.02$ the reciprocal of the value of I for which the ordinates of the curves of figures 4 and 5 are the same.

$n = 0.5$.

$p = 21$ pounds per inch.

$q = 30$ inches.

$h = 2$ inches.

$h_1 = 2.5$ inches.

Let E $= 1{,}600{,}000$.

The scale of deflections therefore is—

$$1\text{ inch} = \frac{rmnpq^4hh_1}{E} = \frac{0.02\times0.5\times21\times30^4\times2.5}{1{,}600{,}000}$$

$$= 0.266\text{ inch.}$$

The ordinates of figure 8 are the same as those of figure 4, Therefore, 1 inch $= npq^2h$ inch-pounds and 1 square inch $= npq^3h$ pounds inches.^{2}

Let 1 inch in figure 9 represent r square inch of figure 8. Then 1 inch $= rnpq^3h$ pounds inches.^{2}

The pole distance in figure 9 varies as the moment of inertia and may be called kI.

The scale of deflection in figure 10 will then be—

$$1\text{ inch} = \frac{kIrnpq^4h}{E} = \frac{krnpq^4h}{E}\text{ inches.}$$

In the present case the pole distance $= 0.05$ I. Therefore, $k = 0.05$. The scale of deflection is—

$$1\text{ inch} = \frac{0.05\times0.5\times0.5\times21\times30^4\times2}{1{,}600{,}000}$$

$$= 0.266\text{ inch.}$$

The scale of figure 10 varies as the pole distance in figure 9, and the deflections represented in figure 10 vary inversely as the moment of inertia. Therefore, if the pole distance varies directly as the moment of inertia, the deflections will be represented in figure 10 to a constant scale.

Analytical Method

In the analytical method, the $\frac{M}{EI}$ curve is computed from the load curve and is in turn treated as a loading curve and moments are figured from it. In this method it is impossible to obtain the deflections from a line other than a tangent to the elastic curve directly. The deflections of the elastic curve and the desired base line must both be computed from a tangent and the results added or subtracted.

Either the $\frac{M}{EI}$ curve can be computed and further work based on it, or the $\frac{M}{I}$ curve can be used and the moments of it divided by the value of E as the last operation before getting the deflection. The latter method is usually preferable, as it gives more convenient figures to work with.

Moments are generally most easily obtained by the method of increments. This is based on the general formula

$$M_b = M_a + S_aX + PX_o$$

Where—

M_b is the moment at point *b*,
M_a is the moment at point *a*,
S_a is the shear at point *a*,
X is the distance from *a* to *b*,
P is the sum of the loads between *a* and *b*,
X_o is the distance from *b* to the resultant of the loads P.

The beam is divided into sections and the moment found at each division point between sections. The work can be most easily done if the work is done in tabular form. Table I shows the computations for the moment and $\frac{M}{I}$ of the same example as was used to illustrate the graphical method.

$$R_1 \times 135 = 7 \times 210 \times 105 + 7 \times 210 \times 70$$
$$= 7 \times 210 \times 175.$$
$$R_1 = \frac{1{,}470 \times 175}{135} = 1{,}905.5 \text{ pounds.}$$
$$R_2 = 1{,}034.5 \text{ pounds.}$$

Table I is aranged in the following form:

Column 1 is headed "Sta." and gives the distance from the left end of the beam.

Column 2 gives the loading in pounds per inch run at the corresponding stations.

Column 3 gives the sum of the adjacent figures in column 2.

Column 4 gives the distance between stations—in this example 15 inches in every case, but it is not at all necessary to have the stations equidistant.

Column 5 is one-half the product of the corresponding values in columns 3 and 4. It is the load in pounds carried by the section of the beam between adjacent stations. It is the quantity represented in the formula by P.

Column 6 gives the shear at each station and is the accumulated sum of the values in column 5. It is represented in the formula by S_a.

TABLE I.

Sta.	*w.*	Sum.	ΔL.	ΔS.	S.	ΔSX₀.	SΔL	M.	I.	M/I.
1	2	3	4	5	6	7	8	9	10	11
0	7.00				0			0	50	0
		15.00	15	112.5		825.0	0			
15	8.00				112.5			825.0	50	16.5
		17.00	15	127.5		937.5	1667.5			
30	9.00				240.0			3450.0	50	69.0
		19.00	15	142.5		1050.0	3600.0			
45	10.00				382.5			8100.0	50	162.0
		21.00	15	157.5		1162.5	5737.5			
60	11.00				540.0			15000.0	50 60	300.0 250.0
		23.00	15	172.5		1275.0	8100.0			
75 R₁	12.00			—1905.5	112.5 —1193.0			24375.0	60	406.25
		25.00	15	187.5		1387.5	—17895.0			
90	13.00				—1005.5			7867.5	60	131.125
		27.00	15	202.5		1500.0	—15082.5			
105	14.00				— 803.0			— 5715.0	60	— 95.25
		29.00	15	217.5		1612.5	—12045.0			
120	15.00				—585.5			—16147.5	60 75	—269.125 —215.3
		31.00	15	232.5		1725.0	—8782.5			
135	16.00				— 353.0			—23205.0	75	—309.4
		33.00	15	247.5		1837.5	—5295.0			
150	17.00				—105.5			—26662.5	75	—355.5
		35.00	15	262.5		1950.0	—1582.5			
165	18.00				157.0			—26295.0	75	—350.6
		37.00	15	277.5		2062.5	2355.0			
180	19.00				434.5			—21877.5	75 40	—291.7 —546.9375
		39.00	15	292.5		2175.0	6517.5			
195	20.00				727.0			—13185.0	40	—329.625
		41.00	15	307.5		2287.5	10905.0			
210	21.00				1034.5			7.5 error	40	0
						21787.5	21780.0			

TABLE II.

Sta.	M/I.	Sum.	ΔL.	ΔS.	S.	X₀.	ΔSX₀.	SΔL.	M.	δ₁	δ₂	δ₃
75	406.25				0		0	0	0	0	0	0
		537.37	15	4030.3		8.78						
90	131.12				4030.3		35,386	0	35,386	0.02211	0.07000	0.09211
		131.12	8.5	557.3		5.61						
98.5	0				4587.6		3,160	34,258	72,804	.04550	.10966	.15516
		- 95.25	6.5	- 309.5		2.16						
105	- 95.25				4278.1		- 668	29,819	101,955	.06372	.13999	.20371
		-364.37	15	-2732.8		6.30						
120	-269.12 -215.30				1545.3		- 17,217	64,172	148,910	.09307	.20999	.30306
		-524.70	15	-3935.3		7.04						
135	-309.40				- 2390.0		- 27,705	23,180	144,385	.09024	.27998	.37022
		-664.90	15	-4986.8		7.32						
150	-355.50				- 7376.8		- 36,503	- 35,850	72,032	.04502	.34998	.39500
		-706.10	15	-5295.7		7.49						
165	-350.60				-12672.5		- 39,665	-110,652	- 78,285	-.04893	.41997	.37104
		-642.30	15	-4817.3		7.73						
180	-291.70 -546.94				-17489.8		- 37,238	-190,088	-305,611	-.19101	.48997	.29896
		-876.56	15	-6574.2		8.26						
195	-329.62				-24064.0		- 54,302	-262,347	- 622,260	-.38891	.55996	.17105
		-329.62	15	-2472.1		10.00						
210	0				-26536.1		- 24,721	-360,960	-1007,941	-.62996	.62996	0
				-26536.1			-199,473	-808,468				

TABLE III.

Sta.	M/I.	Sum.	ΔL.	ΔS.	S.	X₀.	ΔSX₀.	SΔL.	M.	δ₁	δ₂	δ₃
75	406.25				0		0	0	0	0	0	0
		656.25	15	4921.9		8.10						
60	250.00 300.00				4921.9		39,867	0	39,867	0.02492	-0.07000	-0.04508
		462.00	15	3465.0		8.25						
45	162.00				8386.9		25,586	73,829	142,282	.08893	-.13999	-.05106
		231.00	15	1732.5		8.50						
30	69.00				10119.4		14,726	125,804	282,812	.17676	-.20999	-.03323
		85.50	15	641.2		9.05						
15	16.50				10760.6		5,803	151,791	440,406	.27525	-.27998	-.00473
		16.50	15	123.8		10.00						
0	0				10884.4		1,238	161,409	603,053	.37691	-.34998	.02693

Column 7 is the value of the section load from column 5 multiplied by the distance from the right-hand end of the section to the center of gravity of the load. Usually it is sufficiently accurate to assume the center of gravity at the center of the section, but in this case the true center of gravity was used. This is the quantity PX_o of the formula.

Column 8 gives the value S_a X, the product of the shear at one station by the distance to the next station.

Column 9 gives the moment at the various stations. It is the accumulated sum of columns 7 and 8.

Column 10 gives the values of the moment of inertia at the different stations.

Column 11 is the quotient of the values of column 9 divided by those in column 10.

This method of computing moments "by increments" is extremely useful where the load curve is irregular. It can usually be very easily checked. In this case it is evident that the moment at station 210, the right-hand reaction, is zero. The method of increments gives it, working from the left end, as +7.5 inch-pounds corresponding to an error of 7.5/135 = 0.55 pounds in the computation of the reactions, which is negligible. If desired the error can easily be distributed among the values for the moment at the other stations.

The size of section that should be used varies with the smoothness of the load curve, being relatively large for smooth

TABLE IV.—Comparisons of results deflections measured from a line through the supports.

Sta.	Analytical method.		Graphical methods.					
			Single pole.			Multiple pole.		
	Defl.	$\frac{\text{Defl.}}{0.266}$	Defl.	Ord.	Error.	Defl.	Ord.	Error.
0	0.02693	0.101	0.02392	0.09	0.00301	0.02392	0.09	0.00301
15	— .00473	— .018	— .00532	— .02	— .00059	— .00797	— .03	— .00324
30	— .03323	— .125	— .03189	— .12	.00134	— .03455	— .13	— .00132
45	— .05106	— .192	— .05050	— .19	.00056	— .05316	— .20	— .00210
60	— .04508	— .169	— .04252	— .16	.00256	— .04518	— .17	— .00010
75	0	0	0	0	0	0	0	0
90	.09211	.346	.08871	.33	— .00340	.09037	.34	— .00174
105	.20371	.764	.19934	.75	— .00437	.19934	.75	— .00437
120	.30306	1.140	.29767	1.12	— .00539	.29502	1.11	— .00804
135	.37022	1.392	.36412	1.37	— .00610	.36146	1.36	— .00876
150	.39500	1.485	.38804	1.46	— .00696	.38538	1.45	— .00962
165	.37104	1.395	.36412	1.37	— .00692	.36146	1.36	— .00958
180	.29896	1.124	.29767	1.11	— .00129	.29236	1.10	— .00660
195	.17105	.643	.17010	.64	— .00095	.16744	.63	— .00361
210	0	0	0	0	0	0	0	0

The error is computed on the assumption that the analytical method gave the correct values.

curves. It is advisable to have a division point at every point at which the moment may be desired in the further computation and every point where there is a concentrated load or a sharp break in the loading curve, or where the load curves passes through zero. There is no necessity of having the sections equal, though it is usually convenient in the computations.

In Tables II and III the column headed δ_1 gives the deflection from a tangent to the elastic curve at the left-hand reaction. The column headed δ_2 gives the vertical distance from the tangent at the left-hand reaction to a line through both supports. The column headed δ_3 gives the deflection from the line through the two supports.

Tables II and III give the computations for the elastic curve of the beam, Table II for the sections between the supports and Table III for the cantilever. In both cases the deflections are first computed for the tangent at the left-hand support station 75. This is given in column 11. Knowing the deflection of the right-hand support from the tangent it is a simple matter to compute the distance between the tangent and a line through the supports at any point. These values are given in column 12. Column 13 gives the deflection of the beam from the line joining the supports which is the algebraic sum of the values in columns 11 and 12. It should be noted that in Table II the sections are not all of the same length. The 15 inches between stations 90 and 105 was divided into two sections at station 98.5 because the values of M/L change sign at that point.

Table IV gives the values of the deflections from a line through the supports as obtained by the three methods used. The greatest divergence of the graphical method from the analytical is about 0.01 inch in a deflection of 0.40 inch or 2.5 per cent.

Comparison of Methods

The accuracy and precision that can be obtained by the two methods are about equal. It is hard to say which method should be used in any particular case. That depends mainly on the personal equation of the computer. If he has only a 10-inch slide rule the graphical method will often be desirable when he might use the analytical method if he had a 20-inch rule or a calculating machine. A cantilever is easier to compute analytically than is a simply supported beam as the tangent at the support is usually the axis from which deflections are to be measured. In general, the analytical method is slower than the graphical but the latter requires much closer attention to the work as it is hard to construct the force polygon accurately and to draw lines exactly parallel. It is, therefore, hard to keep from making slips in the graphical method and there are not so many opportunities for checking the accuracy of the work as it proceeds.

Very often the computations for several beams can be combined. This happens more often when the graphical method is used than with the analytical. In designing internally braced wings for the Messenger aeroplane, the spars were of uniform cross section and the load on the front spar was a constant times the load on the rear, so one curve could be used for both spars. The scale of the loading curve differed for the two spars and the other scales varied in proportion. The lower wing spars had still different loadings, but they held a constant proportion to the loadings of the upper wing spars. The cantilever lengths differed for the two wings so one figure would not do for both wings, but the two figures could be drawn together with most of the work common to the two figures. By planning the work properly in such cases the labor required to find the deflections can often be very greatly reduced.

The following remarks are made regarding the two forms in which the graphical method is given. When the moment of inertia varies along a curve it is best to use the M/I curve and a constant pole distance changing the pole only when the values of M/I change sign. When the moment of inertia changes at only a few points and is constant between these points it is easier to use the M curve and pole distances proportional to the moment of inertia. There is less chance for error when the pole is changed from one side of the force polygon to the other to indicate a change of sign in the curve from which the force polygon is developed, but the construction requires more room.

New Type Propeller

An Englishman by the name of Bourke has invented a new type of propeller which it is claimed will go a long way in lessening the noise and vibration caused by the existing type of aeroplane propeller. It is claimed by the inventor that his propeller by attaining the maximum of thrust will increase speed and at the same time require less engine power. Instead of being smooth, the blades of the propeller have a number of flanges made of aluminum raised about six inches, which run in parallel lines across the surface and work just as the teeth of a turbine. With the new propeller the wash of the wind from the blades drives in a steady flow instead of striking the planes and struts in whirling gusts thereby increasing vibration. The grip of the serrated blades in the air is much greater, and therefore a much higher speed is obtained in taking off. It is understood that the Handley Page Company contemplate making exhaustive tests of the new invention in the near future.

Safety Precautions for Aeroplanes

According to a report issued by the Safety and Economy Committee of the Royal Aeronautical Society of England, which has made an exhaustive study of the subject of aeroplane accidents, it appears that the primary cause of breakdown is due to faults in the installation of engines and oil, water and petrol systems rather than to failure in the engine itself. Among the various suggestions for improvements, attention is drawn to the need of eliminating leakage of oil, which, it appears, is a serious matter, owing to the currents of air which are set up round the engine in flight. The committee recommends the development of pressure tanks for petrol storage in commercial aircraft, and calls attention to the importance of the use of a sound petrol gauge. It further recommends that rubber connections should be discarded in petrol pipes and that soft steel tubing be substituted.

With regard to engines, the committee urges more drastic tests than those at present made, reproducing as far as possible conditions met in actual use, and that aero engines be so constructed that they will "open out" to full throttle within a few minutes of starting, the practice of running an engine for a quarter of an hour or twenty minutes before opening up to full throttle being considered un economical. Evidence seemed to show that the practice was largely a matter of habit, and that the danger of "opening up" with the engine cold related chiefly to the oil gauges, an objection which could be overcome with suitable instrument devices.

Machines with a single central engine are given preference over those with power units installed in the wings, and the committee recommends a twin-engined aeroplane with two central propellers, one in front of the other. Power installation testing with a machine in flight is also suggested.

The committee urges that undercarriages should be readily detachable from the aeroplane, as under the present practice of building the undercarriage directly on to the aeroplane an accident to the former has meant an accident also to the latter.

NAVAL and MILITARY AERONAUTICS

Radio Controlled Auto at McCook Field

Recent visitors at McCook Field have been astonished at the gyrations of a brightly painted 3-wheeled vehicle which has been dashing to and fro between the buildings and among the airplanes on the field under no visible means of control. It is often seen to approach a group of persons blowing its horn wildly, and then when apparently about to strike them, to stop short with screeching brakes, back up with loudly clanging blow, make a sharp turn to the right or left, and to start off in the opposite direction. Great mystification has been shown as to the method of operation of this car, some visitors even wondering if perhaps a combination of the heat and newly made home brew may not have had a deleterious effect upon their observation powers. They are ofttimes considerably relieved to learn that the car is actually performing as they have seen it, though the mystery is lessened but slightly when they learn that the movements of the car are controlled entirely by radio impulses, which are sent out from the radio station at the opposite end of the flying field. The fact that there is no aerial or antenna system visible merely adds to the mystification.

The car is of cigar-shaped construction about 8 feet long, and runs on three pneumatic-tired wheels. It travels at speed ranging from 4 miles per hour to 10 miles per hour and the controls are so finely adjusted that it may be easily steered along a narrow roadway.

An examination of the interior of the car shows an amazing and confusing collection of batteries, switches, wires, vacuum tubes, potentiometers, relays, magnetos, etc., all of which are, of course, necessary to the complete control of the apparatus. The most interesting part of the apparatus is the "selector" which is in reality the heart of the entire control system. Various combinations of dots and dashes are sent out by means of a specially constructed transmitter, each combination calling for the accomplishment of a certain operation of the control apparatus. It is the function of this selector to "decode" these various combinations of dots and dashes which are sent out, and to close the circuits to the desired controls. So delicately is this selector constructed, and so rapidly will it operate, that it is possible to put into operation any one of 12 distinct controls in a period of less than one second. That is to say, less than one second elapses from the time any push button on the automatic transmitter at the distant radio station is pressed until the control on the car is in operation. Such speed of control has never before been accomplished. This car has been controlled equally well from an aeroplane and from a ground transmitting station.

The possibilities of radio control and its application to wartime problems are almost without number. Radio control can be applied to any mechanical apparatus that moves, whether it be in the air, on the ground, on the surface of the water, or beneath the water. Huge land tanks may be constructed and filled with T N T and driven to any desired point along the enemy's lines where the explosive can be fired by means of radio, or it can be applied in a similar manner to a boat, submarine, torpedo, or even an aeroplane and the explosive can be fired when and where desired. There is also an application in the commercial field, particularly in plants where long hauls between various parts of the factory are necessary.

Secretary of War and General Pershing Visit Langley Field

Secretary of War John W. Weeks and General Pershing, Chief of Staff, recently made the first general inspection of Langley Field since taking up their duties in the War Department.

After making an inspection of the field, which included the hundreds of planes, their crews and equipment, the party was given an exhibition of the planes in flight; pursuit, observation and combat formations being flown. A special demonstration of the efficiency of the new T. M. Scout plane was given by Lieut. Carl Cover, engineer officer of Langley Field. To an observer on the ground this little bird seems to climb a thousand feet as straight as an elevator and, apparently, with the same ease.

The distinguished visitors expressed themselves as greatly pleased with the work of Langley Field, much interest being shown in the enviable record of the aviators in the bombing project of the Provisional Air Brigade.

The Late Lieut. Willard S. Clark

Piloting one of the new Orenco scout planes, First Lieutenant Willard Shaw Clark, Air Service, was killed when his plane fell about 2,500 feet in a tail spin. The unfortunate accident happened at Ellington Field on June 19th.

Lieut. Clark specialized in night flying and was considered one of the most proficient night pilots and instructors in the Air Service. He participated in important searchlight tests conducted by the Air Service at Carlstrom Field in conjunction with the Corps of Engineers, and was highly praised for his meritorious work. Lieut. Clark was a native of Abingdon, Ill., and was 27 years of age. In August, 1917, he enlisted in the Aviation Section, Signal Enlisted Reserve Corps, as a private, first class, and was sent to the School of Military Aeronautics at the University of Illinois in November. He passed his R. M. A. test on May 8, 1918, and was commissioned a second lieutenant on June first following. After a little over two months' service at Love Field, Dallas, Texas, he was transferred to Payne Field, West Point, Miss., on July 24th, and the following month was sent to Carlstrom Field, Arcadia, Fla., for training as a pursuit pilot. Completing this course and also the aerial gunnery course at Dorr Field, he was assigned to duty as pilot instructor. On September 1, 1920, he was commissioned a second lieutenant in the Air Service, Regular Army, effective July 1, 1920, and was immediately thereafter promoted to first lieutenant. On May 9, 1921, he was relieved from duty at Carlstrom Field and ordered to Kelly Field, San Antonio, Texas, for duty with the First Pursuit Group.

Harding Nominates Moffet Rear-Admiral

President Harding has nominated Capt. W. A. Moffett as Chief of the Navy Department's Bureau of Aeronautics, with the rank of rear-admiral. Capt. Moffett has been interested in aviation for several years and is at present in charge of the naval aviation.

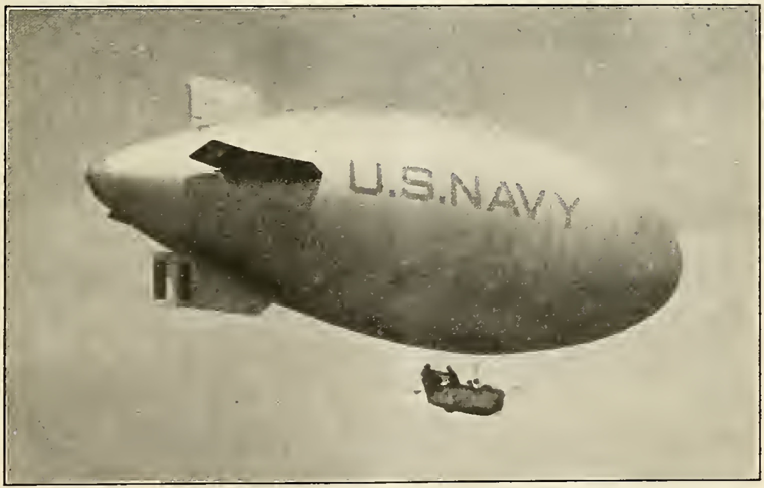


Photo by U. S. Naval Air Service

Towing airship H-1 being tested at Rockaway Naval Air Station. The ship is designed to fly to sea and by attachment to a cable on board ship it is used as a kite balloon for observation purposes. It is equipped with wireless telephone

FOREIGN NEWS

Stuttgart-Constance Air Mail Service

At the present time this service, which has been organized by Paul Strahle, an ex-war pilot, is being run by 3 Halberstadt C. L. IV machines, one of which has been adapted for passenger carrying. The time-table has been fixed to permit of mails being delivered on the same day by the ordinary postal deliveries and also to ensure further despatch by train the same day.

During March 8,000 km. were covered, and only 3 flights did not take place, owing to bad weather. In April, when the weather was much worse, 7,700 km. were flown in the course of 63 flights, of which 50 were mail flights. The journey from Stuttgart to Constance takes 55 minutes by air as compared with 7 hours by water or rail.

"Air Liner's" 10,000 Passengers

The Instone Vickers-Vimy "City of London" has now carried 10,600 passengers, and has done 360 hours' flying. Even giving the machine a full load on each flight, this only makes the average period of each flight about 20 minutes—a fact accounted for by the large amount of "joy-riding" work the machine has done.

Nile Valley Surveyed from the Air

Aerial surveys of the Nile Valley from the Delta Barrage to Aswan have, *The Times* reports, been completed by the Middle-East Air Force on behalf of the Egyptian Government. It is understood that the results of these surveys, which were executed both in high and low floods, are proving of the greatest use to the Irrigation and Survey Departments.

French Aeronautical High Council Created

In association with the French National Defence Council an Aeronautical *Conseil supérieur* has been appointed, and includes M. L. Eynac, the sous Secretary for the Air (President), General Buat, General Dumesnil, Maréchal Fayolle, General Benoist, etc. The Council will examine and report to National Defence Council upon matters and material concerning commercial aviation, watch the application of the aeronautical credits, for possible economies to be effected, generally put forward their views upon aeronautical problems, and make a study of the methods and propaganda of other countries.

The De Haviland Monoplane

We understand that the De Haviland monoplane is practically ready to fly. Its advent is eagerly looked forward to by the aeronautical world, as past experience has shown that De Haviland machines always show progress over their predecessors. In appearance the aeroplane is a large monoplane, not unlike the Fokker F3 which flies on the service from Croydon to Holland. It has cantilever planes with no bracing, and a very deep fuselage, whilst a Napier "Lion" engine provides the power. It is interesting to note that the Napier "Lion" appears to be becoming almost the standard engine for commercial aircraft—great compliment to a great engine.

Ices in the Air

Owing to the abnormal heat, which is unabated to any large extent at the ordinary flying altitudes, Handley Page Transport, Ltd., have introduced a free service of ices to the passengers flying on the London-Paris route. It is proposed to continue this practice as long as the heat wave lasts.

Prague Aerodrome Statistics for 1920

From January 1 to December 31, 1920, a total of 4,694 flights were carried out by 78 Service and 20 Civil pilots.

1,986 passengers took part in these flights. There were eleven accidents in which the machine was damaged, and only three cases—all miltary airmen—in which persons were injured; and this so slightly, that after medical attendance they were able to continue their work.

Thus there was one accident to every 426 flights and one case of injury to every 1,566 flights.

This percentage of accidents, which is, perhaps, high, may be ascribed to the fact that the first grade military school was transferred to the Prague Aerodrome during the year.

In the interest of foreign airmen who do not know the position of the Prague aerodrome, the Aviation Detachment has marked the centre of the aerodrome with a white circle 165 ft. in diameter with the word Prague in the circle, in letters 33 ft. high, direction N.—S.

The circle and letters are white sand, so that the name is legible from an altitude of 6.500 ft.

The ground is being lightly ploughed and rolled, and sown with grass.

International Air Station at Constance

A German aerodrome is about to be established on the German-Swiss frontier, to serve the purpose of an entrance station for Switzerland and international air traffic flying southwards. An inspection of the frontier district has already been carried out by a mixed Commission, formed of representatives of South Germany and Switzerland, Berlin experts on German aviation, and delegates from the Central Air Traffic Office. This commission was authorized at the same time to choose the most suitable place for an aerodrome, and Constance was decided upon. The town of Constance has already agreed to undertake all the necessary improvements.

Aircraft Prohibition in Germany

In consequence of the acceptance of the ultimatum, the German Government is now forced to accept the Entente's Boulogne Resolution of July 2, 1920, extending the prohibition against the construction and importation of aircraft. Consequently, when the Reichstag next meets, a new law will be issued further prohibiting the construction and importation of aircraft material. Thus export orders for aircraft material can no longer be considered. Instructions will be issued later with regard to the disposal of aircraft material constructed in the meantime.

Aviation in the Argentine

Aviation activity in the Argentine is increasing steadily, both in the capital and in the provinces. This country has received recently numerous shipments of flying machines, and is going to receive more. The new machines will develop school flying, and also be used in the organization of regular flights betwen the principal cities in the interior.

Here are the recent shipments and orders of aeroplanes for the Argentine:—

The military aviation school (Escuala militar de Aviación) of El Palomar has just received 15 machines, S.V.A. type, equipped with S.P.A. engines of 220 h.p., bought in Italy, and 20 'planes of the Avro type. These two types of machines are now used in this school, in which the total of the pupils is 40.

The Direction of Aeronautics (Dirección de Aeronautica) has received also, a short time ago, 36 Caudron aeroplanes obtained in Italy at reduced prices, and destined for civil aviation.

The director of the important aerodrome of San Isidro (north of the capital, on the River Plate) received in March, 1921, 14 Curtiss J.N. machines with engines of 90 h.p.; 4 of them were given to the military school, and the remainder are used now in the school managed by the director at San Isidro.

Handley Page received in April, 1921, 20 machines shipped in London, and comprising Bristol, Armstrong and Avro machines.

M. Guichard, a French captain, who was technical director of the French Argentine Air Transport Co., dissolved a few months ago, has bought in France 25 machines, of the types Spad-Herbemont, Potez and A. R. These 'planes were ordered for Argentine civil aviation firms.

The two British companies, The River Plate Aviation Co. and the Anglo-Argentine Aviation Co. (Compañia Anglo-Argentina de Aviación—recently organized), have recently received also important shipments during the last few months.

It is calculated that the number of flying machines bought since March, 1921, amounts to over 150.

This number is demonstrative of the progress realized by Argentina in aviation. The Argentine Republic is one of the leading countries of South America for aerial activities. It is one, too, where the future of aviation is the most promising.

Air Postal Stamps for China

In connection with the Peking-Shanghai air route, the Aeronautical Department is proposing to issue a new set of air postal stamps which will be sold for 15, 30, and 50 cents, respectively. The design of the stamps will be "an airship flying over the Great Wall." They will be inscribed in English and in Chinese "Air Post Service." These stamps will be on sale on the day that aeronautical traffic between Peking and Tientsin is inaugurated.

A "School" Fokker

We learn that a new Fokker mono. has been built for instructional work, and is fitted with a 90 h.p. O.X. Curtiss engine. Instructor and pupil sit side by side, and the machine is dual-controlled. The construction of *fuselage* and tail is in one unit of welded steel tubes.

A New French Air Paper

Les Ailes, a new French air journal, made its first appearance on June 23. The enthusiasm with which our Allies are taking up civil aviation is well shown by the number of air papers which are supported. *Les Ailes* will be concerned chiefly with aerial transport.

African Emir's Flight

The Emir of Katsena, accompanied by his son and staff, visited Kenley aerodrome last week. After a brief inspection of the station, workshops, and machines, the party witnessed some flying by officers of No. 24 Squadron. The Emir and his son and members of the staff were also given flights.

Aerial Motor Cycle

A Reuter's message states that an aerial motor cycle, invented by a graduate of Grenoble University, will shortly be tested in Paris. The inventor claims that he can utilize a propeller and wings attached to the framework to rise several metres and thus cross obstacles.

German Air Mails

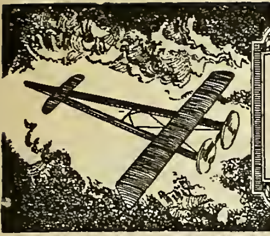
The German daily press takes evident pleasure in recording the additions made during the last few months to the German air mail system. An especially gratifying development is the connection with the British air mail system, which, it is thought, will be particularly helpful in promoting foreign trade. In fact, the air mail schedule on the lines Hamburg-Bremen-Amsterdam and Berlin-Bremen has from July 8th on, been so arranged as to obtain an immediate connection with the Amsterdam-London afternoon service. Flights on the lines Hamburg-Rotterdam and Amsterdam-London will take place on weekdays, while the Berlin-Bremen service is done every day. There will thus on every day of the week be an air mail departure from Berlin, Hamburg and Bremen for the whole of England and overseas countries. All (ordinary and registered) correspondence will be admitted for conveyance between Germany and England, fees (in addition to ordinary postal fees) being the same as for transmission to Holland—viz., 40 pfennigs for postcards, 40 pfennigs (for each 20 grammes) for letters, 1 mark for each 50 grammes in the case of printed matter, samples, commercial papers. Air mail transmission for postal parcels is admissible between Germany and Holland.

New Australian Air Services

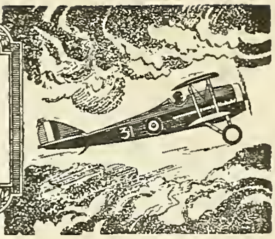
In addition to the air services to isolated districts in West Australia, it is stated that the Australian Government has decided to inaugurate services between Sydney and Adelaide and Sydney and Brisbane, and tenders have already been invited.

Berlin-Russia Air Service

A German aeroplane belonging to the Sablatnig Co. has arrived at Reval *en route* to Soviet Russia. It is proposed to establish an intermediate station at Reval when the prospective air service between Soviet Russia and Berlin has been established.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Models by "Aerial Age" Readers

ANOTHER enthusiastic reader of the Elementary Aeronautics Page and builder of successful duration models is Ernest A. Walen, of 254 North Grove St., East Orange, N. J. He has been a model enthusiast for the past ten years, formerly residing in Springfield, Mass., where he was a member of the Springfield Model Aero Club, and it is only recently that he resides near New York.

One of the model types designed by Mr. Walen is a single propeller pusher model, which is pictured below. In this model the rubber elastic is enclosed in the fuselage, so that the resistance of the rubber is lessened. The framework of the fuselage is 1/16-inch square wood, with diagonal braces of silk thread. The framework is entirely covered with rice paper and doped with banana oil. Wings are built up in the usual manner with bamboo ribs and pine beams. Covering is applied to the top surface only. The propeller is twelve inches in diameter.

Mr. Walen's particular interest is in distance and duration models and at present he is in possession of several of these types. Most of his flying consists of "solo" work, as he has not yet become acquainted with others in his vicinity whose interests coincide with his own. If there are any clubs or individuals in or near New York who are interested in arranging some distance or duration flights, Mr. Walen will be glad to have them communicate with him so that it will be possible for him to resume the pleasant and interesting associations always to be had when model fliers get together.

Ralph Rapien, of Norwood, Ohio, has completed a scale flying J.N.-4 model, which makes flights of 150 feet. It has a span of 36 inches and a chord of 4 inches. The propeller is 10 inches in diameter. The weight complete is 11 ounces. Some of its constructional features are: propeller hub-plate complete with bolts; wing panels connected with 5/16-inch steel bolts; struts attached to fittings by means of small bolts; shock absorbers provided for landing gear and tail skid.

One of the "A" frame racers built by Mr. Rapien has a 21-inch span, 4½-inch chord; front lifting plane 9 inches in span and 4½ inches in chord. For the motive power 70 feet of ⅛-inch flat rubber drives two 6-inch propellers. On this machine the wings were tested with the Glenn L. Martin No. 2 High Lift Section, which proved to have more than the average strength of structure. Tests showed the machine to be capable of high forward speed and rapid climb—but not suited for distance flights.

A 6-foot twin tractor monoplane, constructed to resemble a large bombing plane, has been designed and will be built by Mr. Rapien. The general dimensions of this plane are as follows:

Span	6 feet
Chord	9 inches
Overall length	54 inches
Overall height	14 inches
Wing Section	Martin No. 2
Weight (approximately)	25 ounces
Propellers (two)	10 inches

About 125 feet of ⅛-inch flat rubber will be used. The propellers rotate outwardly at the top and in opposite directions. The elastic strands run parallel to one another and attach to the stabilizer plane. Beyond the stabilizer is a one-piece elevator, adjustable from the front cockpit. The Loening type bracing is used for the wings in which is employed two diagonal struts on either side of the fuselage. Wings are set at two degrees incidence.

The fuselage has a maximum depth of 8 inches, is 3½ inches wide and 48 inches in length. Landing wheels are 4½ inches, carried on a ⅛-inch axle, 12 inches long.

Miscellaneous Notes

An aerial motorcycle, invented by a French University graduate, is to be tested soon in Paris. The inventor claims to be able to rise from the ground by means of a propeller and wings attached to the framework of the machine, to a height sufficient to clear fences and other obstacles near the ground.

Approximately 500 boys have been taken into the Royal Air Force as a result of examinations for boy mechanics held in Great Britain early this year. The successful candidates will be trained in various skilled trades in about the following proportions: 150 carpenters, 30 coppersmiths, 10 draftsmen, 300 fitters and 10 patternmakers.

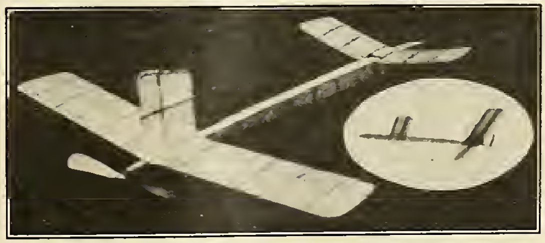
A preparation made for dissolving rubber was used in 1783 for preventing the escapement of gas from the envelopes of free balloons. It is said that this preparation has not been excelled for the purpose even at this late date.

Although German Aeronautic Societies are encouraging experimentation with small low-powered sport aeroplanes, the tendency of the British aeronautic press is to discourage attempts along this line. German aero enthusiasts are also turning their attention to gliders of original and elaborate construction, due, no doubt, to the regulations forbidding commercial aeroplane construction.

In designing propellers for models the following rules will be found to serve the purpose where extreme accuracy is not required. The diameter of the blades should be as large as consistently possible. This factor is usually determined by the ground clearance permissible by the design. The area of the blades should be approximately one-tenth of the area swept. The pitch should be about four-fifths of the diameter, depending principally upon the forward speed. The speed of rotation should be small, as this will conserve the power. As the speed of rotation is increased it is necessary to reduce the diameter. It will be found that the highest thrust will be obtained when the propeller has large diameter and slow speed.

Aeroplane Models to be Shown at International Aero Congress

It is reported that several of the finest model aeroplanes in the United States, most of them built by readers of the Elementary Aeronautics Page, will be exhibited at the International Aero Congress, which will be held in Omaha, Nebraska, November 3d, 4th and 5th. Negotiations are under way for the purchase of some of the striking models described in Aerial Age from time to time during the past six months. Mr. Earl W. Porter, president of the International Aero Congress, has taken considerable interest in some of the scale models pictured in Aerial Age, and it is expected that they will be arranged as a prominent attraction during the event.



A 90-seconds duration model built by Ernest A. Whalen. Insert shows the model in flight at an altitude of 50 feet

A-E-R-O-N-I-T-I-S

They All Flop Sooner or Later

Monte Rolfe

JOE BROWN and I.
WENT FOR a ride.
IN JOE'S Ford.
AND AFTER riding.
MANY MILES.
WE REACHED the field.
WHERE CRAZY men.
TEMPT PROVIDENCE.
BY GOING up.
IN AEROPLANES.
JOE SAID I'll fly.
IF YOU will too.
I SAID, "Poor Nut."
THE HEAT has made.
HIM LOSE his mind.
"FOR ALL the money.
IN THIS world.
IS NOT enough.
TO COMPENSATE.
ME FOR the risk."
BUT JOE was firm.
AND SO at last.
I WEAKENED.
AND WE flew.
WHEN WE got.
INTO THE plane.
I FELT.
HORRIBLY SCARED.
BUT WAS ashamed.
TO LET Joe know.
SO I said nothing.
BUT I felt.
VERY WEAK.
THE MOTOR started.
I FELT weaker.
WE LEFT the ground.
AND I felt weaker.
BUT WHAT is this.
I FEEL better
I ENJOY it.
IT IS beautiful.
IT IS wonderful.
I AM not weak.
ANY MORE.
I WANT to fly.
FOREVER.
BUT THE pilot.
HAS NO soul.
AND HAS stopped.
THE MOTOR.
AND WE are gliding.
SLOWLY DOWN.
WE HAVE landed.
AND NOW I want.
TO LEARN to fly.
AND BUY a plane.
AND FLY each day.
AND I want.
THE WORLD to know.
THAT FLYING is.
GREAT.

Color Not Important

We'd be a blonde, or deep brunette;
We really don't care which,
So long as we're not sick abed,
And reasonably rich.

—*American Legion Weekly.*

Lady Bountiful

Rounder: "I kissed Helen on the forehead."
Bounder: "And what did she do?"
Rounder: "She called me down."

—*American Legion Weekly.*

AWOL

The lovelorn swain, in days gone by,
"Oh, darling, fly with me!" would cry.
But now he whispers tenderly,
"Go absent without leave with me."

—*American Legion Weekly.*

"Do you smoke?"
"Yes."
"Well, here's a box to keep your matches in."

A Matter of Looks

A homely young English chap, having his view obstructed by the headgear in front of him, ventured to protest. "See here, miss," he said, leaning over, "I want to look as well as you."

"Oh, do yer?" she replied, with a rich Cockney accent. "Then you'd better run 'ome and change yer fice."

—*Boston Transcript.*

The Flight

By George J. Gould

Up above in the Heavens of blue,
Way up above where things are new,
Way up above where I'm nearer to you,
I am soaring.
Gliding along through the snowy cloud,
Gliding along where glory's shroud,
I am roaring,
Through azure seas.
The sun shining through way up above,
Shining through with that pure soul of love,
Onto my plane like a pure white dove,
I am dreaming.
Then as I fall,
I hear the birds that call,
My heart goes out, and gives them my all,
My heart is beaming,
For nature that flies.

Coming nearer the ground,
All safe and sound,
Crowds gather round,
"How was the flight?"
Asking me silly things.
Praises they start to sing,
Pilot of the wing.
All this world is bright,
Gay plane of Heaven.

I had an awful dream,
An' it seem
We went up for a jazz in the air,
And I was holding my sweetheart's hand,
While I was making a "land,"
With a BaCo ship
And we made some awful dips,
While I was kissing her lips
We spun, nose-dived and looped,
And then I awoke.

—*Rupe.*

Question: I made an aeroplane, and when I tried it out, it wants to fly on its back. What can I do?

Answer: Put the seat on top of the plane and change the wheels. —*Rupe.*

Quite Natural

"Strange," murmured the magazine editor, "that this anecdote about Lincoln in his early days has never been in print before."

"It isn't strange at all," returned the contributor with some indignation. "I just thought it up last night."

—*American Legion Weekly.*

The Airman's Wish

By John W. Hiney

I'd like to go a flying
With a girl I know,
I'd like to take her with me
Where e'er I go.

I'd fly across the ocean
With her I'd land in France,
I'd have her sit beside me
If I only had the chance.

I'd make a trip to Egypt
The Pyramids to see
And I'd keep the plane fogging
If she'd only go with me.

I'd fly across the desert
Above the drifting sands,
I'd make a trip to Russia
Thru the Holy Lands.

I'd fly to Hawaii
Where we'd rest awhile;
Then to California
That beautiful sun kis'd clime.

There amid the roses
We would build our nest
And pass our days in happiness
In the golden west.

Aerial Opportunities

of the finest kind are still within the grasp of enterprising pilots. The most profitable and pleasant flying months of the season are still ahead. Facts, figures and several years experience of our organization in developing **COMMERCIAL AVIATION** is at the disposal of pilots and business men, who are interested in the purchase of commercial aircraft as a payout proposition. Remarkable values in new, up-to-date airplanes, two, three or more passenger models of proven commercial merit are available.

AVRO-CANUCK for 2-3 passengers
LARGE AIRLINERS for 4-5-6 passengers
ALL AIRCRAFT MATERIALS

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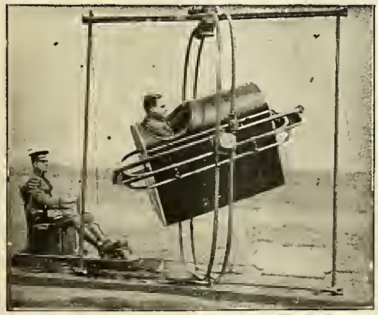

were manufactured by the U. S. Government under the supervision of the inventor. Duplicates—with improvements—will now be manufactured for civilian aviation schools, also 2 passenger models for amusement park purposes.

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Allowed and Pending

Ruggles Orientator Corporation
168 W. 73d Street, New York City

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Below Extract from Our

SPECIAL PRICE LIST

to

Aeroplane Owners and Operators in U. S. A.

WRITE FOR ONE

IMPORTANT: All quotations made herein are in U. S. funds. Boxing charge will be made as per schedule below.

TERMS: CASH WITH ORDER

WING PANELS

CANUCK—J.N's.	
UPPER, with fittings	$135.00
UPPER, without fittings	120.00
LOWER, with fittings	125.00
LOWER, without fittings	115.00
CENTER, with fittings	20.00
CENTER, without fittings	18.00
AVRO	
UPPER and LOWER	$175.00
CENTER	55.00

AILERONS

CANUCK	
UPPER, with fittings	20.00
UPPER, without fittings	17.50
LOWER, with fittings	15.00
LOWER, without fittings	13.00
AVRO	
UPPER and LOWER, without fittings	45.00

ELEVATORS	
CANUCK or CURTISS TYPE	12.00
RUDDER	
CANUCK or CURTISS TYPE	12.00
STABILIZER	
CANUCK or CURTISS Horizontal	35.00
CANUCK or CURTISS Vertical	10.00

NOTE: All surfaces listed here are covered.
On uncovered surfaces a discount of 33 1-3% is allowed on Canuck and Curtiss types and 50% on Avro types.

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CANUCK or CURTISS, with wheels and tires	115.00
CANUCK or CURTISS, without wheels or tires	75.00
AXLE	4.50
VEE (Lower Fitting), Canuck or Curtiss	6.00
STRUT	2.25
PROPELLER	
For Canuck or Curtiss, with O.X.5	18.00
For Avro, with Clerget, 130 H.P.	40.00
TAIL-SKID	
CANUCK or CURTISS, assembled	8.00
CANUCK or CURTISS, wood only	1.75
CONTROL	
RUDDER BAR, complete with spindle	3.50
CONTROL STICK, Front with fitting	4.00
CONTROL STICK, Rear with Trunnion Fitting	5.00
RADIATOR PLATE	
CANUCK TYPE	18.00
RADIATORS	
ROME TURNEY HONEYCOMB TYPE	20.00
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Ericson Standard Type (Canuck)	1.50

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We have made an arrangement with Mr. Alexander Klemin by which he will refer to us certain classes of inquiries that he is no longer in a position to handle since his engineering organization has been taken over by the Cox-Klemin Aircraft Corporation.

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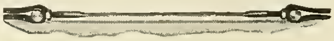

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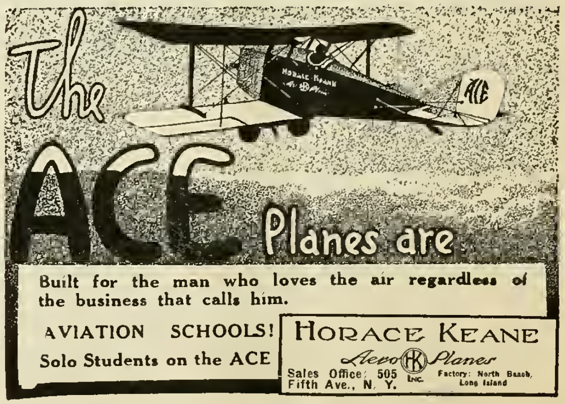

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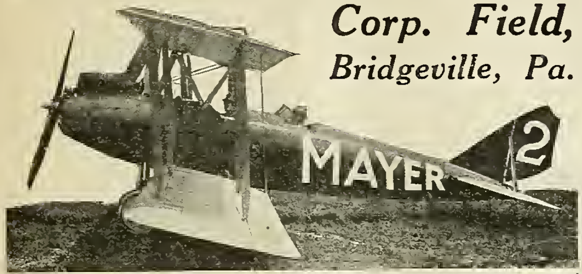

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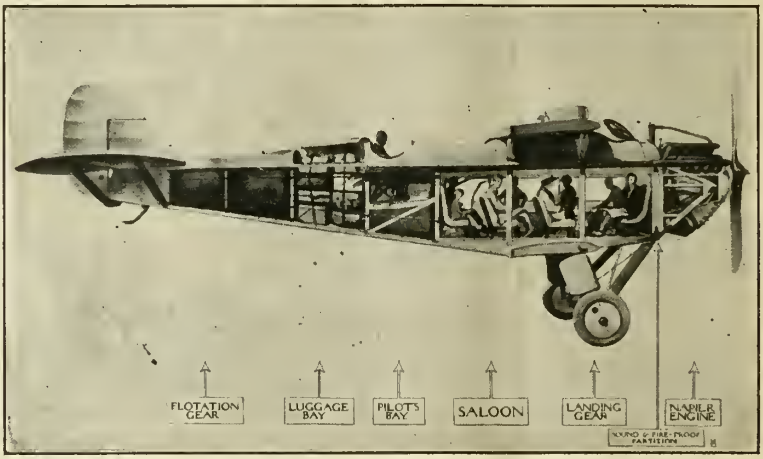

The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

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New American Dee	2500.00
Standard, practically new, with new motor	2000.00
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Standard Fuselage	600.00
Standard or Curtiss Wings, each	150.00
Beardmore Motors, 160 H.P. Excellent condition	650.00
New OX5 Motors in original crates	525.00
Used OX5 Motors, 10 to 25 hours....300.00 to	400.00
New Radiators, Standard or Curtiss	25.00
New Wheels **$10.00.** New Wheels with streamline	12.00
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New Seat Cushions	2.50
New Canadian Pit Cowls with windshields	45.00
New Canadian Elevators or rudders	15.00
Engine Bearers	2.00
Landing Gear Struts	3.00
Landing Gear Strut Fittings	3.50
½" Shock Absorber Cord guaranteed, per foot	.05
Linen Tape, per yard	.09
Champion Spark Plugs	1.00
Waltham Watches, 8-day radium face	20.00
Water Temperature Gauges	6.50
Cabane Struts, each	1.00
Peach Basket	3.00
Axles, New, Curtiss or Standard	3.00
Hispano Cylinder Blocks	200.00
Curtiss Wing Spars	5.00
Souvenir Propellers, Foreign and American Four Blade **$10.00.** Two Blade	5.00
Brass Screws, 2 x ½, ⅝, ¾, 1, per gross	.50
Wing Ribs, Webs, Cap Strips, each	.05
Nickel Steel Bolts, all sizes, each	.05

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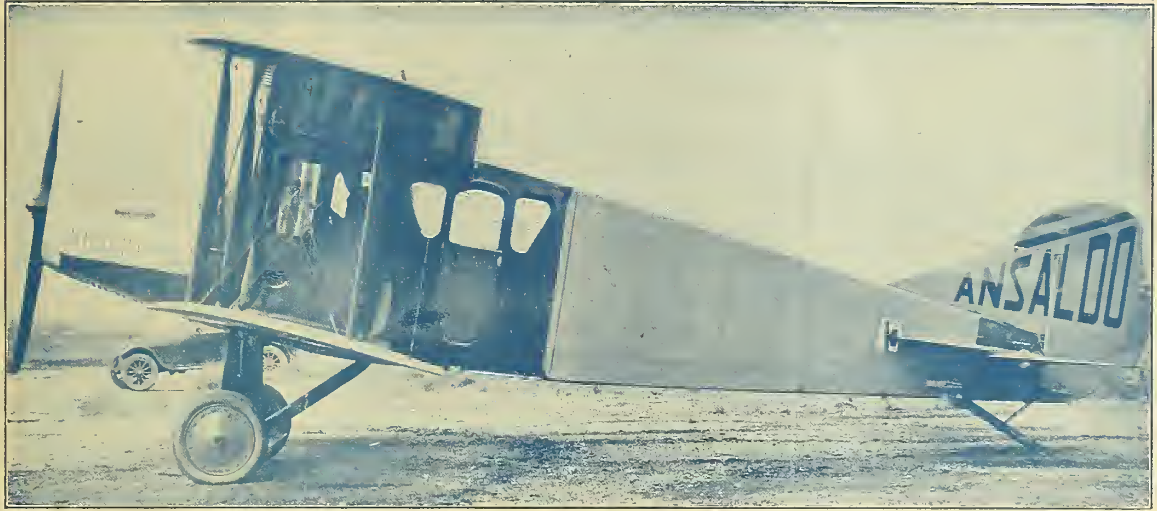

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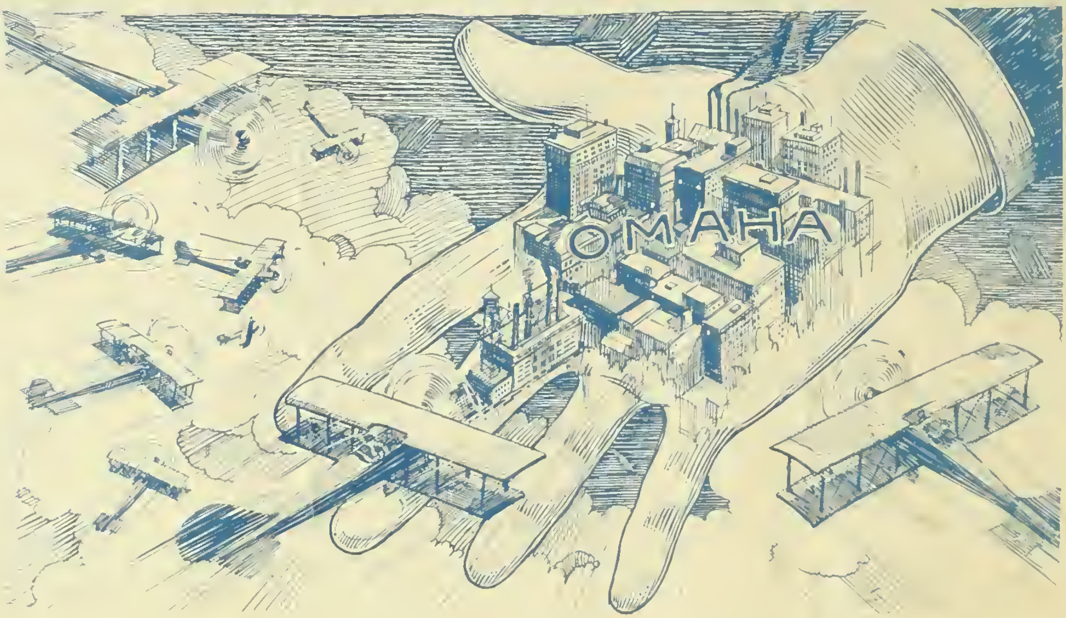

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International Aero Congress

Omaha, Nebraska November 3, 4, and 5, 1921

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Aero Club *of* Omaha, Inc.
Omaha, Nebr.

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601 Peters Trust Bldg., Omaha, Nebr.
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Name ....
Address ....
A-A

The Carey Printing Co. Inc.
New York

AERIAL AGE WEEKLY

OL 13, No. 24 AUGUST 22, 1921 10 CENTS A COPY

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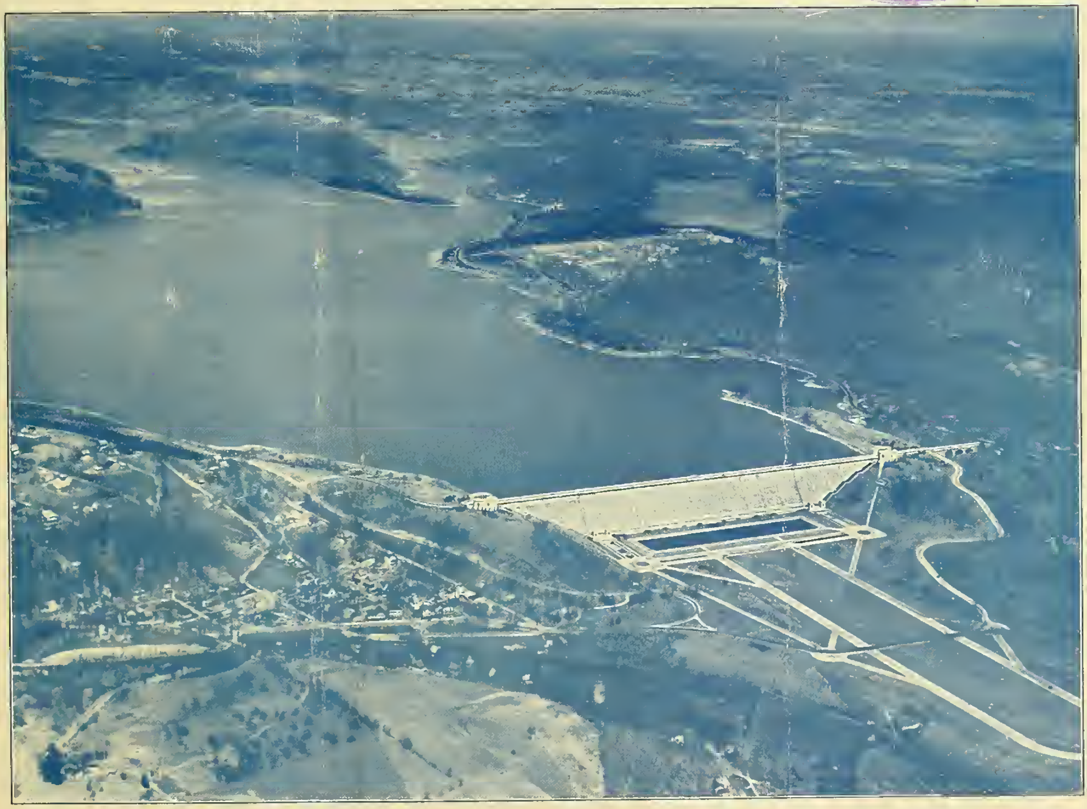

Airscape of the Kensico Dam, Photographed for the Fairchild Aerial Camera Corp., by W. L. Hamilton

Aero Club of America Inaugurates National Membership Campaign

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
bscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

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The *Boeing Sea-Plane* is manufactured by the Boeing Airplane Company, Seattle, Wash.

The planes are located at the Naval Air Station, San Diego, Calif

They are new and unused and have not been removed from the original packing crates.

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AUGUST 22, 1921

AERIAL AGE WEEKLY

VOL. XIII, No. 24

TABLE OF CONTENTS

Aero Club of America Inaugurates National Membership Campaign 559
Curbing Reckless Aviation........ 560
The News of the Week........... 561
The Aircraft Trade Review....... 562
U. S. Post Office Department Air Mail Service.................. 562
Aeronautic Roads............... 563
Prevention of Fire by Self-Sealing Tanks...................... 564
Omaha Gets Pulitzer Race........ 565
Plans of the American Airways.... 566
Dirigibles Superior for Forest Fire Prevention.................... 570
Foreign Technical Digest......... 570
Naval and Military Aeronautics.... 571
Foreign News................... 572
Elementary Aeronautics and Model Notes....................... 573
Aeronitis...................... 574

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Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

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THE STATE OF KANSAS AND PART OF MISSOURI	**Williams & Hill Airplane Company,** Arkansas City, Kansas.
THE NEW ENGLAND STATES	**Curtiss New England Airplane Company,** Garden City, Long Island, N. Y.
THE STATES OF TEXAS, OKLAHOMA, AND UNASSIGNED TERRITORIES	**Curtiss Aircraft Corporation,** Garden City, Long Island, N. Y. Love Field, Dallas, Texas.
ALL COUNTRIES OF SOUTH AMERICA	**C. W. Webster,** Curtiss Aeroplane & Motor Corporation, Garden City, Long Island, N. Y.

DEALERS

THE STATES OF MASSACHUSETTS AND RHODE ISLAND	**Lynnway Aerial Transportation Company,** 7 Central Square, Lynn, Mass.
PARTS OF THE CAROLINAS	**H. L. Morrow Company,** 540 S. Tryon St., Charlotte, N. C.

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WEEKLY

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TECHNICAL, ENGINEERING AND TRADE
AUTHORITY
With which is consolidated
Flying

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VOL. XIII NEW YORK, AUGUST 22, 1921. NO. 24

AERO CLUB OF AMERICA INAUGURATES NATIONAL MEMBERSHIP CAMPAIGN

THE Aero Club of America, which is the authoritative body representing national and international aeronautical affairs, has inaugurated a national membership campaign. Benedict Crowell is chairman of the membership committee, of which the other members are Howard E. Coffin, E. V. Rickenbacker, and P. J. Roosevelt.

The purposes of the Aero Club of America are directed to the advancement of all phases of aeronautics, including military and naval activities relating to national defense, the development of commercial aviation, the air mail service, the enactment of federal legislation governing aerial navigation, and the industrial and technical progress of the art and science of aeronautics.

As a non-partisan and constructive force for the national good, its influence is being extended to every state, every county, and every local community, and reorganization makes membership possible to all those everywhere, who are interested in aviation.

Through affiliation with the Federation Aeronautique Internationale, direct contact exists with the aircraft activities of all other countries of the world.

Members are kept in touch with world progress in aircraft, and the best organized thought of the country upon aeronautical issues will be transmitted to the legislative branches of state and federal government.

That our country may acquire and maintain leadership in this newest and fastest means of transportation, so intimately interwoven with all future plans for our national security and defense, is the desire of every American, and every reader of AERIAL AGE can render direct aid and support in this important end by putting the weight of their influence into the work through membership in the Aero Club of America.

Achievements of the Aero Club of America

The Aero Club of America is the mainspring of the aeronautic movement in this country, and before the war aviation received its chief support from this organization.

Long before America's entry into the conflict, when the United States Army and Navy had less than thirty aviators, the club undertook to train airmen and to form aerial reserves. Through these extraordinary and patriotic efforts over three hundred flyers were trained, many of whom joined the Lafayette Flying Corps while the others were commissioned in the Army and Naval Reserves authorized by Congress and organized by President Wilson upon the recommendation and as a result of the activity engendered by the Aero Club. These were the very first A. E. F. aviators to be sent overseas.

By means of energetic and well-directed national campaigns, the Aero Club of America was responsible for securing large appropriations for military and naval aeronautics, and urged the adoption of adequate plans for aerial preparedness.

Through the Club's offer to pay the salaries of flight surgeons, when there was absolutely no provision for same, the Medical Section of the U. S. Army Air Service was established, its services saving many hundreds of lives.

In Paris the Club organized a Foreign Service Committee, composed of prominent American members residing there, whose high standing in France and whose personal knowledge of the country enabled the committee to be of invaluable service and comfort to aviators, at the front and elsewhere.

As a result of the Club's strenuous fight, backed editorially by AERIAL AGE, and success in impressing Congress with the importance of encouraging this newest means of transportation, legislation to reduce the pay and rank of American aviators was defeated.

The Aero Club of America is the national organization, founded in 1905, and composed of clubs and individuals throughout the United States.

Some of its objects are:

To advance the development of the science of aeronautics.

To encourage aerial navigation, conferences, expositions, congresses, and contests.

To maintain headquarters wherever necessary for the accomplishment of the organization's purposes.

To cooperate with the Federal Government in whatever direction may be considered advisable and feasible to promote the advance of aerial development.

Invitation to Clubs to Affiliate

The following letter has been sent by Chairman Crowell to all aeronautic clubs and organizations throughout the country:

My Dear Mr. Secretary:

In the belief that aerial development urgently needs a National clearing house in Washington, D. C., the Aero Club of America has transferred its legislative and general membership departments to the National Capital.

Affiliated clubs never before have been asked to pay any membership fees, but it now becomes necessary to call for a nominal annual contribution to the work which must be carried forward if the United States is to keep pace with other countries in aerial development.

Your organization will be represented on the National Council, which will be called together periodically to discuss policies and methods for carrying out a definite program. Congress will not concern itself in aircraft progress unless convinced of a country-wide sentiment favorable to such an undertaking.

Timely bulletins will be sent to your organization, and in addition to the member on the National Council you will name representatives on several National committees entrusted with developing the plans outlined by the National Council and the Aero Club of America.

We hope your club will accept an affiliation with the Aero Club of America. With headquarters in New York and Washington we will be well-equipped to become most effective as the great National channel, enlisting the interest of all advocates of this newest transportation.

Very sincerely yours,

Benedict Crowell, *Chairman.*
Philip J. Roosevelt,
E. V. Rickenbacker,
H. F. Coffin,
A. G. Batchelder,
Membership Committee.

Club Enrollment Form

The following form may be used by clubs that have not yet made application for affiliation:

To the Board of Governors:

Gentlemen: The undersigned aero club hereby makes formal application for affiliated club membership in the Aero Club of America, accompanying such application by a list of officers and membership list as of date.

This form of membership requires the payment of an annual fee based on the number of members:

Clubs having 100 members or less, $10.

Clubs having not more than 250 and not less than 100 members, $25.

Clubs having not more than 500 and not less than 250 members, $50.

Clubs having not more than 1,000 and not less than 500 members, $100.

Clubs having not more than 1,500 and not less than 1,000 members, $150.

Clubs having not more than 2,000 and not less than 1,500 members, $200.

Clubs having not more than 3,000 and not less than 2,000 members, $250.

Clubs having not more than 4,000 and not less than 3,000 members, $300.

Clubs having not more than 5,000 and not less than 4,000 members, $350.

Total Membership...... Name of Club..................
Amount Paid........... Secretary......................
Date.................. Address........................

Officers of Club

President ....
First Vice-President ....
Second Vice-President ....
Treasurer ....

Representatives Council and Committees

National Council ....
Airports and Landing Places.........................
Foreign Relations ....
Contests ....
Legislation ....

The letter inviting individual membership is as follows:

My Dear Sir:

In the heart of every American I believe there rests the conviction that the future safety and welfare of our nation is vitually concerned in the proper and aggressive development of our air power.

Aerial transportation calls for governmental and public support, if America intends to keep pace with other countries in building up a commercial development that may be quickly converted into a means of national defense. Every day brings indication of the rapid strides of other countries in the advancement of aeronautics.

The activities of the Aero Club of America are being so reorganized and broadened as to make it more effective to serve as the great national channel for the clearance of aeronautic information, and through which may be expressed to our legislative and administrative bodies the best thought of the country on aircraft affairs.

Commercial aviation is the reservoir from which surplus craft and men would be available in time of stress. America should look ahead and encourage the new form of transportation, and we urgently desire your support in this movement, through membership in the reorganized Aero Club of America.

Will you not please fill out and return the enclosed membership blank with your check for the first year's dues?

Very sincerely yours,
Benedict Crowell, *President.*

Application for Aero Club of America Membership (Metropolitan)

To Membership Committee of the Aero Club of America:

I desire to signify my interest in Aeronautics by applying for membership in the Aero Club of America through its New York City division, and I agree to abide by its rules and requirements. Remittance is enclosed to cover National and Metropolitan dues for one year from date, $30, plus 10 per cent tax, $3.

Signature ....
Address ....

Forward with remittance to Aero Club of America (Metropolitan Headquarters), 11 East 38th Street, New York City.

Application for Aero Club of America Membership (National)

To Membership Committee of the Aero Club of America:

I desire to signify my interest in Aeronautics by applying for membership in the Aero Club of America, and I agree to abide by its rules and requirements. Remittance is enclosed to cover National dues for one year from date, $110.

Signature ....
Address ....

Forward with remittance to Aero Club of America (National Headquarters), Mills Building, Washington, D. C.

Curbing Reckless Aviation

The fine of $50 imposed in a Chelsea, Mass., court on an aviator for flying an aeroplane in such manner as to endanger life is of more than local importance. The defendant was charged with flying over a neighboring beach at an elevation of only 100 feet, and gave notice of an appeal from the decision.

Precedents in the legal regulation of aviation are so few that the progress of this case in the higher courts will be watched with interest. Flying is something new to the law and the disposition of flyers to take risks which endanger not only themselves but spectators appears to need the application of judicial restrictions. The practice of speeding aeroplanes over crowded grand stands or other public assemblages specially invites the attention of the law. The way to regulate is to regulate, and the attempt of a local court to curb aspects of flying which threaten public safety will be commended as a promising beginning.—*(Editorial in N. Y. World.)*

THE NEWS OF THE WEEK

Better Business Outlook For Aircraft Builders

New York—J. K. Robinson, Jr., President of the Manufacturers Aircraft Association, Inc., 501 Fifth Avenue, New York City, reporting on the condition of the aircraft industry, stated recently:

"The readjustment of the aircraft industry to a substantial basis, from which it can begin to build a solid and profitable commercial business, has been practicably accomplished. The achievement is regarded as unique and should provide considerable encouragement to long established lines in other fields of transportation which have been suffering from temporary depression.

"The aircraft industry is the newest activity bidding for recognition as a serious factor in modern business. It was nonexistent before the war. During the war it was expanded tremendously and when the war ended, it was left literally suspended with a capitalization of a hundred million dollars and a pay roll of several hundred thousand persons.

"Liquidation occupied 1919, the strictly war production firms going out of business. In 1920 the remnants of the legitimate aircraft industry encountered a season of extreme discouragement. Delay in recognition by the country of the potentialities of aircraft forced sharp contraction and the absence of any governmental policy of law or regulation made commercial aviation financially hazardous.

"This year, which has seemingly been marked by industrial depression generally, has witnessed an upturn in the aircraft industry. The fifteen or twenty manufacturing plants have been readjusted to a sound operating basis. Experimental engineering has greatly improved the usefulness and safety to aircraft. The thousand or twelve hundred aeroplane operators have definite assurance in the President's message, that, before many weeks, an aerial code will be passed, thus giving the entire art a legal status. With this constructive legislation actually in sight, the aircraft industry is making renewed efforts to exploit commercial aviation and there is gratifying indication that the public is ready to accept aircraft as an expeditious means of transport supplementing the railway, steamship and motor car, and that forestry, agriculture, mining, banking, photography, surveying, fishing, advertising, etc., will pay liberally for the improved and unique service which the commerical aeroplane offers."

Tests of the Remington-Burnelli Airliner

The test of the Remington-Burnelli Airliner to ascertain its aerodynamic efficiency and stability have developed very satisfactorily and are indicative of the considerable improvement in twin engine aeroplane performance. Up to August 12th the plane had made over forty test flights and had a total time in the air of twenty-one hours and reached an elevation of eight thousand feet, the longest single flight being two and one-half hours. The following expert test pilots have flown the plane to pass opinion on its conventional handling qualities, as well as their speculative elements, Bertrand V. Acosta, who conducted the initial test of the plane and flying it without and preliminary ground work; Lloyd Bertaud of the Ansaldo Company; Randolph Page, test pilot for the Aerial Mail, and Clarence B. Coombs, who is now conducting very exact performance tests. In view of the fact that this giant plane was designed for 550 horse power Packard motors, the flying qualities obtained through the use of direct Liberties which caused the plane to be about twenty-five per cent under power, is very promising and in fact, out of the ordinary. Now that the plane has proved its qualities in actual flight, beyond question, the installation of a permanent power plant will be affected. The unusual departure and speculation in the design of this plane recommended an extremely conservative policy in its testing. Therefore, cross-country trips and haphazard passenger flights have been discouraged. As soon as the final tests of this plane are completed and its new power plant installation thoroughly worked out, some record breaking cross-country flights can be expected, which will be to the good interest of commercial aviation. Too much significance and credit cannot be attached to this private aeronautical development as it has proved that the aeroplane is not restricted to a limited and impractical proportion of design that has heretofore been apparent. Rather the accommodation, comfort and accessibility, provided it be worked out in a correct engineering way, will greatly increase the performance and reliability of the future aeroplane.

Chicago-Twin Cities Air Mail

Lack of appropriation of funds by Congress has caused the suspension of the Chicago-Twin Cities route of the Air Mail, but only for the time being it is hoped.

Aero Club of Pennsylvania

At a recent meeting of the Aero Club of Pennsylvania D. J. Spence Jr. and A. Stanley Truscott were added to the Board of Directors.

Kokomo Aviation Meet

According to W. M. Fagley, secretary of the Curtiss-Indiana Company, the aviation meet which will be held at Kokomo, September 22-24, is an assured success. Great local enthusiasm has been aroused and a substantial list of contestants will compete.

Aerial Afternoon Teas

Afternoon Teas in Mid-air are the very latest hobby of Leon Errol. Having exhausted all the thrills of a daily indulgence in "Nineteen" holes of golf on every individual course within one hundred miles of his make-up mirror, and mastered the motoric mysteries of his new Six Cylinder Road Bus, the comedian-star of Ziegfield's "Sally" has permitted his well known sporting proclivities to back-slide to his realest love—aviation. Mrs. Leon Errol, who was the first woman ever to fly from Southampton to London—to and from a transatlantic liner—shares the aerial diversion of her hubby and lends an added air of social eclat to the air-tour by pouring tea for the guests who accompany them on their matinee cloud-spins, as they skim up and down the Harbor and around the Statue of Liberty for a breezy jaunt two afternoons a week.

A young nephew of the star Errols, recently returned from France; Mr. and Mrs. E. F. Flammer, Mrs. N. Holde and Mr. Phil Ruxton completed the party on yesterday's flight in the big Fokker cabin-de-luxe plane from Mitchel Field, Mineola.

The Alps By Aeroplane

Berne.—Trips to Alpine resorts by aeroplane are promised for next summer. The safe landing of the airman Durafour on the snow fields of the Dôme du Goûter, at a height of 14,210 feet, or 1,572 feet below the summit of Mont Blanc, is, according to the officials of a Swiss aeroplane company, only the beginning of a new era in Alpine tours.

The ordinary ascent of Mont Blanc from Chamonix takes sixteen hours, and the night must be spent at a height of 10,000 feet. The ascent from the hut must be begun not later than two hours after midnight, so that the ascent and descent can be made before the snow is much softened by the sun. By aeroplane tourists will be able to leave Chamonix about an hour and a half before sunrise and reach the Dôme du Goûter in about twenty minutes. Then, with a guide, they can reach the summit in another hour and watch the sunrise from the highest European mountain. Similarly, it will be possible to see the sunset from the summit.

Alpine aeroplanes will be stationed at all climbing centres, such as Zermatt, Arola, Grindelwald and Pontresina. Aeroplanes will be able to take passengers to the summits of certain mountains, for instance, from Zermatt to that of the Breithorn, which is 13,685 feet high, or from Zermatt to that of the Wellenkuppe, 12,830 feet high. But for mountains crowned with slender ridges of rock and snow or for rock peaks like the Matterhorn planes will land passengers on the snow plateau below the summit, whence they will be taken the rest of the way by guides.

The guides are alarmed at this prospect, but the aeroplane people say that more tourists will be ascending peaks for the sake of the view from the summits than ever ascended for the sake of climbing proper, and that the fees obtained for taking aerial passengers from the landing places to the actual summits will exceed those now earned from climbers.

Possible landing places in the high Alps are already being carefully examined by air pilots and mechanics, and planes will be specially constructed for landing on snow.

Each plane will carry six passengers and six guides and the passengers will be provided with the necessary equipment for the final ascent. The expense of an ordinary ascent, including that of spending the night in a hut, is hardly less than $40 for one person, and the cost of the plane trip is expected not to exceed $25 including pay for the services of a guide from the landing place to the summit.

Personal Par

Mr. and Mrs. Henry P. Davison have announced the engagement of their daughter, Alice T. Davison, to Artemus L. Gates, who won fame on the football field and the battlefield and now is seeking it in the field of finance, being connected with the New York Trust Company. Gates was in the Naval Air Service.

Mayer Aircraft Corporation Active

The Mayer Aircraft Corp., of Bridgeville, Pa., has been doing good business for the last ten months. This corporation has the backing of C. P. Mayer, the Bridgeville sportsman, businessman, coal and oil magnate and air enthusiast.

The flying end of the business is in charge of three very efficient pilots, Lt. Robert E. Dake, Lt. Howard Blanchard and Lt. O. E. Schleifer.

The company has two landing fields equipped with modern hangars and complete supplies for Lairds, Orioles, Standards and JN4's are always available.

The company is now engaged in passenger carrying, advertising and photographic work and contemplates establishing an aerial transportation line between New York and Pittsburgh and Pittsburgh and Chicago in the very near future.

Atlantic City Fields

The Curtiss Aeroplane & Motor Corporation has two stations at Atlantic City, one, for hydroplanes, located at the inlet, at the extreme eastern end of the boardwalk, the other for landplanes, located about one-half mile inland, at the other end of the city, alongside the principal boulevard leading out of Atlantic City.

The water station, for hydroplanes, can be distinguished by the name on the roof of a large brick hangar. There are two hangars at the airport for landplanes. Supplies can be bought by wiring the Curtiss Flying Station.

New Baltimore Company

The American Aircraft Inc., of Baltimore, was recently organized for the purpose of manufacturing, assembling, and distributing standard and custom built planes, specializing in the "Canuck" and OX5 motors.

The company also maintains a department of operations embracing all the branches of commercial aviation, the department being in charge of experienced and competent pilots.

The aerodrome is situated at Logan Field, Md., five miles southeast of Baltimore. The plant and stores are situated at Dundalk, Md., a short distance from Logan Field.

All the personnel of the organization are among Maryland's pioneers in aviation. The officials of the company are Robert J. Stewart, president and treasurer; George O. Blome, secretary. The directors are F. G. Ericson, R. J. Stewart, G. O. Blome, W. H. Campbell, B. Gordon.

Ayars Returns to California

F. C. Ayars, who has been associated with Georges Voisin of Newark in aeroplane covering and repairing for some time is establishing an expert repairing and covering shop in the vicinity of Los Angeles, Cal., in the near future. Mr. Ayars is a charter member of the Aero Club of Southern California and is quite well known on both coasts, having been associated with the Interallied Aircraft Corp., Witteman-Lewis Aircraft and other manufacturers in similar work.

Curtiss Buffalo Field

The Curtiss Aeroplane & Motor Corporation Field at Buffalo is located 7 miles northeastward of the city and about 2 miles east of the large bend in the Niagara River northward of the city of Buffalo.

The field is easily distinguished from the air by a long scraped runway, but care must be taken in landing, as there are several cross ditches; these are, however, marked by red flags. The field has two hangars and is open from April 2 to December 1. Supplies and services are available.

Indianapolis Industrial Exposition

A number of aeronautic manufacturers will be represented at the Indianapolis Industrial Exposition to be held at the Indiana State Fair Grounds, October 10-15, under the auspices of the Indianapolis Chamber of Commerce.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, June, 1921

														SERVICE AND UNIT COST				
DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
															hr. min.			
St. Louis-Twin Cities	$3,592.65	$835.77	*$6,605.32	$1,114.50	$850.09	$215.60	$2,048.26	$866.32	$3,322.36	$4,109.30	$1,647.32	$624.81	$25,832.30	10,267	394 17	31,678	$65.52	$0.82
New York-Cleveland.	2,807.17	593.54	1,400.70	2,431.13	812.84	393.61	1,730.46	477.55	2,800.03	2.132.05	1,098.21	416.54	17.193.83	7,632	308 05	27,756	55 80	62
Cleveland-Chicago.	2,252.18	480.23	3,119.84	1,347.73	724.23	108.23	1,188.59	433.16	2,020.01	1,850.35	823.66	312.41	14,660.62	6,087	208 52	17,979	70 14	.82
Chicago-Omaha	3,062.40	577.57	1,911.57	619.49	617.82	67.41	934.34	577.55	2,576.25	2,719.03	1,098.21	416.54	15,178.18	8,614	274 23	23,686	55 31	64
Omaha-Salt Lake.	4,783.75	1,334.66	**7,111.25	1,649.25	577.44	194.75	1,863.40	1,203.22	4.486.66	3.785.95	2,287.95	867.79	30,146.27	15,220	556 33	48,324	54 16	62
Salt Lake-San Francisco	3,125.93	722.98	†7,772.93	1,073.90	336.09	130.72	1,728.93	866.32	3,691.86	2,746.84	1,647.32	624.81	24.468.63	10,053	406 17	35,668	60 24	69
Totals and Averages....	$19,624.08	$4,544.75	$27,921.81	$8,236.00	$3,918.51	$1,110.32	$9,493.98	$4,524.12	†† $18,897.17	$17,343.52	$8,602.67	$3,262.90	$127,479.83	57,873	2,148 27	185,091	$59 33	$0 69

* Includes new motor in plane No. 147.
** Includes cost of rebuilding plane No. 182.
† Includes new wings on plane No. 167.
†† Five days' additional pay to pilots on account of changing dates of making mileage payments.

Cost of dismantling College Park and Heller Fields, formerly on New York and Washington Division	$4,162.35
Loss on unrepairable crashes	8,000.00
Total operating costs	$127,499.83
Grand Total	$139,642.18

Overhead consists of: Departmental overhead; office force and watchmen; motor cycles and trucks; rent, light, fuel, power, telephone and water; radio.

Maintenance consists of: Miscellaneous; mechanics and helpers; repairs and accessories and warehouse.

Flying consists of: Gas; grease and oil; and pilots.

COST PER MILE

Division	Overhead	Flying	Maintenance
St. Louis-Twin Cities	$0.17	$0.24	$0.40
New York-Cleveland.	.16	.22	.24
Cleveland-Chicago	.18	.26	.38
Chicago-Omaha	.13	.26	.25
Omaha-Salt Lake	.12	.22	28
Salt Lake-San Francisco	.13	.21	.35
Entire Service.	.15	.23	.31

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

AERONAUTIC ROADS

By STORY B. LADD

THE growth of aviation will require the posting of the country, so that a flyer can lay his course direct for his objective point and can, en route, check and correct his course for air drift and verify his position. It is proposed to post the country on a block system which can be added to or differentiated as the growth of air travel requires, and whenever or wherever "road signs" are installed, whether under national or state auspices, by aero clubs, Chambers of Commerce, or other organizations, they will be in harmony with the general plan and become a part of the system.

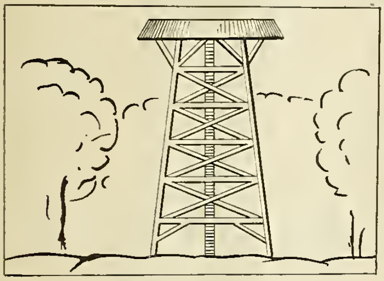
The country is to be laid out in 400-mile blocks, taking the 95th meridian and the 40th parallel as base lines. The 400-mile blocks will be subdivided into quarter sections of four 100-mile blocks, and the latter into 20-mile units. On the posted routes there will be elevated platforms at 20-mile block corners, showing from above a shape indicative of the 100-mile block and the quarter section, and a number identifying the 20-mile block unit.

All platforms in a 100-mile block will be of like shape or contour, with a short projecting arm indicating the quarter section, and will differ from those of adjoining blocks. The number shows in the center, placed to be read from the south, and will appear separate and detached from the surrounding platform, in the middle of an open central field. Four shapes will suffice,—circular, triangular, square, and trefoil.

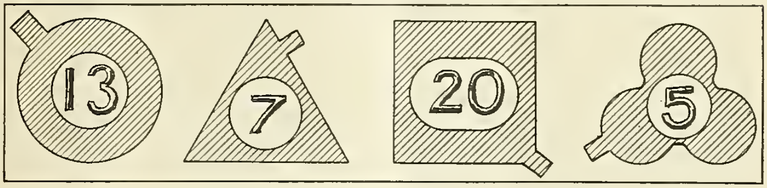
The platform structures will stand high enough to clear surrounding objects and in forest and timbered districts will show above the trees. In open country an elevation sufficient to be out of the way of cattle and drifting snows will suffice.

In the mountains or broken country, when the true location of a tower comes in a gorge, or where it would not be visible from a distance, it will be located at the nearest available point, the off-set showing on the map. The map can also show in forest and mountain districts, the direction and distance from a tower to the nearest open area available for an emergency landing, and the nearest town where oil can be obtained.

It will be necessary to preserve visibility when the ground and the platforms are covered with snow. For this purpose the platforms are made with a skirt around the edges, sloping outward at a steep angle, and painted black. From above this skirt will appear as a black line around the outer edge of the platform. Snow may adhere thereto to some extent on the windward side after a storm but sufficient portions will be exposed to catch the eye. To maintain the visibility of the numbers under snow conditions, they can

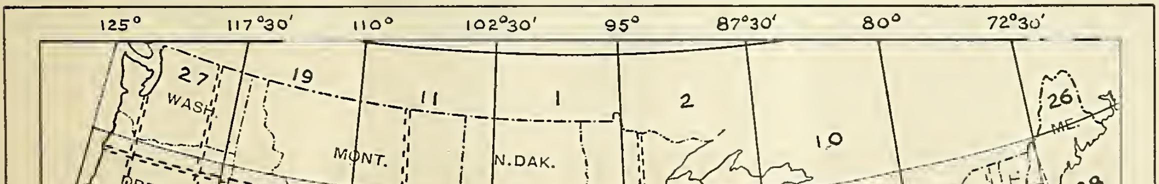


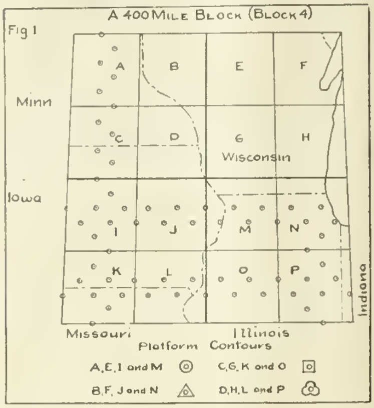
Marker platform



Circular, triangular, square and trifoil markers

Aviation Road Map—Block System





be made with hipped lines of steep slopes, and painted black.

Though in winter, in some districts, a platform may carry a heavy blanket, there will be open space around the number, and the lines will be sufficiently exposed to be decipherable.

The 400-mile blocks, the major units, are numbered for purposes of designation, from the 95th meridian, west and east, the odd numbers to the west and the even numbers to the east, beginning at the north and in consecutive columns. On the 40th parallel, seven and a half degrees of longitude is approximated, 400 miles (400.725 miles) and the meridians at 7.5° intervals, east and west from 95°, have been taken for the north and south lines of the major blocks, as per accompanying map. Though all north and south divisions will be distances of 20 miles or multiples thereof, the east and west divisions will vary with the latitude, being 20 miles or multiples thereof on the 40th parallel and ranging from approximately 17.7 miles at the Canadian border to 22.6 miles at the Gulf.

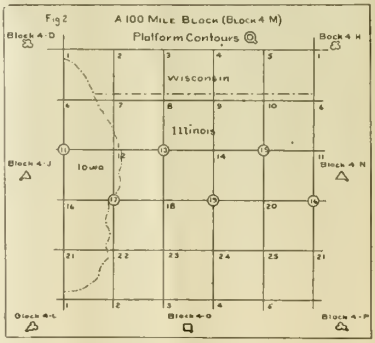
A major block comprises sixteen 100-mile units, lettered, for purposes of designation, A to P, beginning at the northwest corner and in quarter section groups (See Fig. 1). Thus, "16M" (the 100-mile unit M in block 16) indicates the 100-mile block in southeastern Georgia and northern Florida, and "27J" the Seattle block in Washington. In like manner, "31D" is the San Francisco block, and "20O," New York City and its environs.

The 100-mile units or blocks are subdivided into minor units, 20 miles square (except as to the variations due to latitude), numbered 1 to 25, beginning at the northwest corner of the 100-mile block. These are the tower or platform numbers. In designating the position of a tower, the number follows the block letter, and the major block number precedes it. Thus "20M 7" identifies a tower location (the tower may or may not be installed) contiguous to Albany, N. Y., and "15G 13" Denver, Colorado.

The accompanying map shows the major block system and indicates certain posted routes for purposes of illustration. Figure 1 is a diagram of Block 4, which covers portions of Minnesota, Iowa, Missouri, Wisconsin, Illinois and Indiana, and Figure 2 illustrates a 100-mile block (4M) in northwestern Illinois, with portions of Wisconsin and Iowa. The diagrams show alternate installations for the posted routes between two parallel lines, though it may be preferable to provide continuous postings on a single line.

A flyer may not be able to read the number from a considerable elevation, but if knowledge of the 100-mile block from the platform contour is not sufficient, he can descend low enough to decipher the number.

There is a possibility for duplicate markings in the major blocks, but any duplications will be 400 miles or more apart, and it is assumed a pilot will know his position within that range. Duplications with respect to contiguous blocks can, in the main, be avoided in laying out the posted lanes. Referring to the map, block 22 shows postings for north and south, and east and west routes, and towers alike in contour, quarter section designation, and number are possible for blocks 22 and 20 and blocks 22 and 14. But a pilot would know his position as between North Carolina and Pennsylvania or as between northern Virginia or West Virginia and Indiana.



When traffic between two points becomes dense enough to warrant it, the direct route can be continuously posted by supplying the diagonal installations.

For night service on a route where there is regular travel, the platforms can be equipped with lights under radio control, so that an aircraft, with wireless control equipment, can, at will, cut in the lights within range. A view of the platform lights within range of control will enable the pilot to confirm his position and course, and lights will be on only as needed. With the posting of a comparatively few east and west, and north and south lanes, the country will be served. For example, for a trip from Chicago to El Paso, Texas, if the postings indicated on the map are installed, a flyer after leaving Chicago will sight "4M 13" and "4M 17" in eastern Illinois; then in northwestern Missouri he will cross the north and south and the transcontinental lane shown on the map near their junction point. There will then be no road sign until he strikes the southern transcontinental lane which he should cross, on a true course, at "17F."

PREVENTION OF FIRE BY SELF-SEALING TANKS

NUMEROUS attempts have been made to perfect a petrol tank which would be proof against leakage in the event of being punctured and proof against fire when pierced by incendiary bullets or other projectiles. Before such a device was perfected, approximately 75 per cent of the fatalities due to aircraft could be directly attributed to the fact that the fuel tanks were pierced, and the leaking petrol became a source of danger. Mr. Jack Imber, of London, England, undertook to study the requirements of a self-sealing tank, and his researches led to some remarkable discoveries.

A small bullet can inflict extensive damage when passing through a petrol tank. In many cases, it is found that an ordinary bullet will tear a hole six or eight inches in diameter in the side of the tank opposite to that through which the bullet enters. This phenomenon perplexed many inventors who were seeking to keep the petrol from leaking from bullet holes. Most of the devices failed, for either they were too heavy or some important detail of the structure was not properly disposed, because the actual forces existing in a tank under such circumstances were not understood.

Before giving a detailed description of the tank invented by Mr. Imber it may be well to present the theories upon which the invention is based.

A bullet entering a fuel tank makes an aperture of the diameter of the bullet itself. In emerging, however, a very much larger hole is torn in the metal.

Investigation showed that the larger hole was due to the enormous pressure of fuel against the far side of the tank.

On entering the tank the progress of the bullet is partly arrested by the liquid, and sets up in the liquid a pressure wave which increases both in area and force from the point of entry to a distance of approximately 2 ft. 6 in. Thus, when a bullet travels through a tank, its momentum is reduced; but, on the other hand, in a tank of ordinary size, it is found that up to a certain point the farther one side wall is from the other the larger will be the hole torn upon the exit of the bullet, because the pressure wave in the liquid is the main cause of the large hole torn at the exit.

It was seen that the pressure generated in the tank would either have to be confined or released. Many inventors sought to confine the pressure, but results showed that when the bullet made its exit the pressure sought release through the aperture made by the bullet, and in its effort to escape an enormuos rupture is made in the tank.

Having found the cause of the damage to a petrol tank when it is pierced, Mr. Imber was in a position to seek a means of protecting a tank to such a degree that not only would it prevent leaking when pierced, but it would also prevent the escape of the liquid in the event of a bad crash.

Tanks which had a small measure of success in stopping simple petrol leakages utterly failed to retain the liquid when the machine crashed. It is this latter feature which specially commends itself to the present designers of commercial aircraft, for it is well known that many crashes that in themselves do not result seriously are disastrous because the tank is unable to withstand the impact, and a fire follows.

The Imber principle is to allow the energy of the pressure wave to dissipate by providing the tank with a resilient outer rubber covering, so that when the pressure exceeds a certain point, the tank yields and the rubber stretches out from the side of the tank under pressure. Naturally, the highest point on the stretched rubber covering is that through which the bullet makes its exit, and the rubber being stretched makes this point also the thinnest portion of the covering, so that when the bullet leaves, and the pressure is relieved, the rubber goes back to its former shape, and completely closes up and seals the bullet hole.

When the Imber tank first appeared, it was suggested by other experimenters that angular section braces for framework and diaphragm or baffle-plate supports should be used. Failures resulted, because when the metal brace was bent outwards against the covering, it required great pressure from the covering to force the frame back into place, and allow the rubber covering to assume its normal position. The aluminum tubing employed by Imber, after being bent outwards, is brought back into place with a great deal less pressure than that required to bend it in the first place.

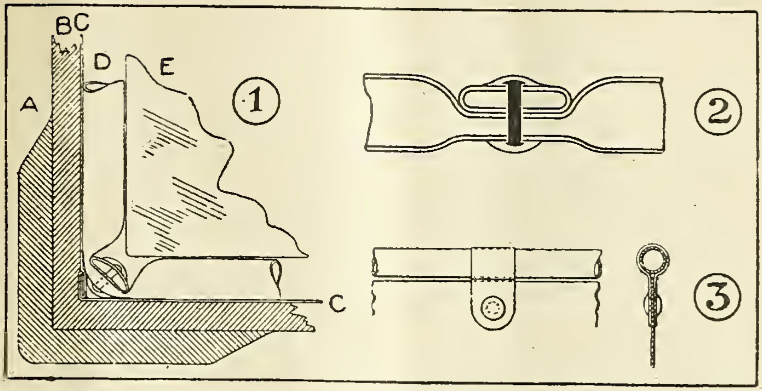
The elasticity of the rubber covering is sufficient to force the bent tubular members back, so that the bullet hole is closed; but, in cases where other inventors used angle frames, the rubber covering was torn by the unyielding metal.

The Imber tank is composed of three parts, which are shown in section in the sketch: The inside tubular aluminum framework to which sheet aluminum baffle-plates are attached. The framework is adapted to fit within and conform to the shape of the shell. The second part of the tank consists of a metal shell into which the baffle-plate frame is inserted. The third part of the tank consists of an outside rubber covering which surrounds the entire shell. The resilient or elastic covering returns to its seating against the framework in such a brief space of time that it is impossible for the contents to ignite in the event of the projectile being of an incendiary nature.

The tank is installed in the aeroplane by means of a cradle, in such a way that no rivets, bolts, etc., are used to secure it to the machine.

The general arrangement of the internal cradle or framework and baffle-plate is shown in one of our photographs. Of course, the principle is applicable to tanks of any shape or any size.

The framework is built up of aluminum tubing about 5/16 in. in diameter, and 22 gauge in thickness. The diameter and gauge of material varies according to the size of the tank. Where the tube crosses one another they are held together by rivets as shown in Fig. 2, or they may be welded together. Baffle-plates are secured to the framework by means of aluminum clips as shown in Fig. 3. The entire framework, together with the baffle-plates, is constructed so that no rivets or other means are used to hold it in place in the shell. It is imperative that the inner cradle be not fixed in any way to the metal shell.



Some details of the Imber tank: 1. Section of a corner: A, rubber reinforcing; B, rubber covering; C, outer shell or casing; D, framework members; E, baffle plate. 2. Method of crossing the tubular members of the framework and of securing them with rivets. 3. The method of clipping the baffle plate to the inner framework of the tank

The function of the framework is to form a backing against which the rubber covering may seat itself to form a self-sealing covering.

The shell or casing is made of tinned steel. Other materials, including copper, were found to be inferior in some respects to the material finally adopted. Tanks with a capacity of more than 38 gallons are made of 28 gauge tinned steel. Joints are formed as indicated in Fig. 1. The joint is sweated, welded or otherwise formed without the necessity for the employment of rivets or other members passing through the metal.

The outer covering is of specially prepared rubber, which is put over the entire surface of the tank. The rubber is approximately ¼ in. in thickness. Edges of the tank are reinforced with an additional rubber strip ¼ in. thick, vulcanized to the covering rubber. The entire tank is then vulcanized for about 75 minutes under a steam pressure of about 40 lbs. per sq. in.

In order to provide for the greater security of the tank against leakage, all fittings are provided with double seatings, so that in the event of one joint giving away there will still be a second joint to prevent leakage.

In one convenient form of fitting the desired effect is obtained by having a flange internally threaded bush sweated upon the inside of the casing and surrounding the aperture for the fitting. Into this is screwed a second bush or sleeve carrying the fitting which makes the first-mentioned member a joint by means of fibre or packing. This second bush or sleeve projects beyond the rubber covering of the tank, and is surrounded by a metal washer which is forced into close contact with the exterior of such covering by means of a flange upon such sleeve so as to form a second joint or seating for the fitting. The inner bush is so constructed and arranged that it is practically flush with the inner surface of the metal shell.

No part of the fitting is allowed to project into the tank in a manner which would prevent the aluminum framework from being slipped into the tank.

Minor shocks are, of course, taken care of by the rubber covering, but when a hard blow is struck the internal construction gives. While the framework is strong enough to give adequate bracing to the tank under ordinary usages, it is purposely made collapsible upon the application of a blow likely to cause a puncture. In the case of a landing in which a smash occurs, the rubber covering retains the petrol, no matter how badly the tank may have been battered. While the framework of an aircraft may crumple and strike forcefully against the tank or the tank strike the ground, the result will merely be a distortion of the shape of the tank, thereby minimizing the danger of fire from the inflammable liquid that otherwise would have been sprayed about the wreckage.

OMAHA GETS PULITZER RACE

THE 1921 air race for the Pulitzer Trophy—the world's most important prize for speed in the upper realms—will be flown this year at Omaha, Neb., Nov. 3, under the auspices of the Aero Club of Omaha.

Announcement to this effect was made last night in the wideawake Nebraska city by Earl W. Porter, President of the club, and assurances were given that the 1921 contest will be conducted in a manner commensurate with the classic quality of the prize and the high standards established in the 1920 race, which was held last Thanksgiving Day with the starting and finishing point at Mitchel Field, Long Island.

Omaha will have to step along in lively fashion to equal the splendid arrangements which prevailed on that occasion—and the flyers will have to breeze through the air at terrific speed to equal the record established on that memorable day—but according to all reports received from the bustling Mid-Western city the circumstances surounding the second test of high-speed ships will equal, if not excel, the first.

Following is the official announcement of the race made last night at Omaha:

"The Pulitzer Trophy race will be the stellar attraction of the International Aero Congress, and the combination of the two events will make of the Omaha meeting the greatest aerial congress ever held in the United States. Forty-four of the world's best flyers were entered in last year's Pulitzer race and an equal or larger entrance list is anticipated for the Omaha race.

"The entire Executive Committee of the World's Board of Aeronautical Commissioners, consisting of a member from each of ninety-seven different countries, and the entire Executive Committee of the Aero Club of America will be at the meeting, according to President Porter.

"Capt. C. C. Mosley, winner of last year's Pulitzer race, will defend his title and cup, but whereas last year his plane traveled 132 miles in forty-four minutes and twenty-nine seconds, experts arranging for the coming race predict the winner must do better than 178 miles an hour to gain first place.

"One of the interesting entrants is a new type of biplane, which is to be entered by the navy. The navy has not announced the speed this new ship has attained.

"The International Aero Congress, at which the Pulitzer race will be the chief event, has arranged for a national reunion of airmen, in which 10,000 former flyers are expected to take part. At the congress the airmen are expected to form a national organization similar to the American legion but to which only former flyers will be eligible.

"Another feature of the congress is an aerial exhibit to comprise every type of plane, balloon, blimp and other aircraft manufactured, including parachutes, bombs, guns, aerial cameras, mosaic maps, Government exhibits, and everything pertaining to the air.

"The air meet, for which $15,000 in prizes has been offered, will consist of derbies, sprints, climbs, stunts by balloons and planes and flying boat. The Tri-City Derby will include Omaha, Des Moines and Kansas City.

"An aerial pageant, written by Rupert Hughes and Eddie Deeds, will be one of the features. The pageant depicts the bombing of a French village by German planes and the conquering of the German aviators by American aces. Fifty-two American aces have accepted invitations to the congress and will take part in the pageant."

There was great rejoicing here in New York when word was received that the 1921 Pulitzer Trophy race would be held in such promising circumstances, and the following statement was issued by the Aero Club of America:

"The Contest Committee of the Aero Club of America states that the Pulitzer Trophy race, originally scheduled for Detroit, Sept. 10, will be held in Omaha, Nov. 3, 1921. The Detroit Aviation Society requested the Aero Club of America that they be permitted to postpone conducting this event until 1922 due to the failure of the Secretary of War to approve the appropriation recommended by Gen. Mitchell for Government participation in this event.

"The Aero Club of Omaha, having raised by public subscription sufficient funds to pay the expenses of Government and private participants, has made it possible for the Pulitzer Trophy Contest to be held this year. Their liberal contribution toward the advancement of American aeronautics is greatly appreciated by the Aero Club of America, the Air Services and all of those interested in aviation."

Solely the lack of funds prevented the Government from entering its army and navy racing ships. Both Secretary Weeks and Secretary Denby of the Navy expressed to Mr. Bragg and to various Detroit representatives, including H. E. Coffin, their deep personal interest in the race and extended to those visitors their best wishes for its success.

While Omaha gets the race this year, there is no doubt that Detroit will try to make it a still greater event in 1922.

PLANS OF THE AMERICAN AIRWAYS

A CONTRACT for the instruction of disabled war veterans in aeroplane mechanics has been awarded to the American Airways, Inc., of College Point, Long Island, by the Bureau of Vocational Training for Disabled War Veterans.

The American Airways, Inc., have prepared a plan of instruction which eclipses anything hitherto attempted outside of the Army and Navy Air Services, and it is so thoroughly broad in scope that the company is rendering a distinct service to the aeronautic industry because of the practical character of the work.

Major W. G. Schauffler, Jr., of the U. S. Army Reserve Corps, is president of the American Airways Inc., and is one of the most experienced pilots in the United States. He received his initial training at San Diego in 1915. In 1916 he joined the New Jersey Naval Reserve Aviation Corps and was acting Chief Petty Officer at the Naval Reserve Airdrome at Keyport, N. J. Early in the summer of 1916 he transferred to the Atlantic Coast Aeroautical Station at Newport News and completed his civilian flying training there, receiving experts' licence No. 72 of the Aero Club of America. In November, 1916, he enlisted at Fort Monroe and continued his flying training under army instruction, being commissioned a Lieutenant in the Signal Officers Reserve Corps and placed on active duty with the Third Aero Squadron on April 2nd, 1917, four days before the declaration of war with Germany.

He was transferred to the First Aero Squadron and landed in France with his unit September, 1917. In France he rendered distinguished service and was decorated by the French for galantry in action, and cited on numerous occasions. When he was honorably discharged in October, 1920, he was chief instructor Officers' Course at Langley Field.

Hugh D. McKay, Vice President of the company, was a lieutenant in the Canadian Flying Corps, and was an instructor at Leaside and Everman Field. Mr. McKay, prior to entering the service, was a newspaperman on the staffs of the New York Sun, Philadelphia Public Ledger, New York American, Los Angeles Examiner, and is now associated with one of the largest advertising agencies in New York as special counsel.

Captain T. L. Tibbs, chief instructor of the American Airways, is a Canadian by birth, but was educated in England. He rendered distinguished service in the Canadian Infantry, and in the Canadian Air Force. He commenced his commercial aviation with the Trans Oceanic Company. He subsequently joined the flying personnel of the Aeromarine West Indies Airways where he made a notable record for safety and reliability. He has a total of 1970 flying hours to his credit.

Captain G. W. Furlow, technical instructor, was a captain in the U. S. Air Service Reserve Corps. He saw service in France, participated in the Meuse-Argonne drive and was decorated with the D. S. C. and one oak leaf.

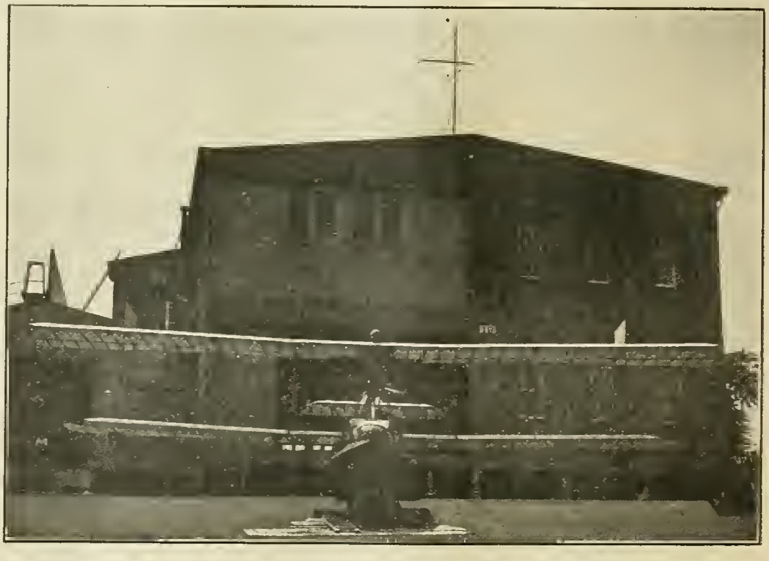
Captain Neil Murphy served with the Canadian forces and acted as adjutant and wing transport officer at Deseronto. He is a specialist in ignition.

Charles Richardson, who secured his technical education at Glasgow University, the leading educational institution in Scotland, is lecturer in wireless and military engineering.

Following is a resume of the American Airways course:

Preparatory General Course 8 Weeks

(a) Lectures on Commercial Aviation:
  History of Flight.
  Military Aviation During the War.
  Influence of War on Commercial flying.
  Recent Developments in Europe.
  Progress of Commercial Aviation in U. S.
  The Future of Commercial Aviation.
  Requirements of Commercial Flying.
  Type of Machines.



The establishment of the American Airways, Inc., at College Point, Long Island, with one of the company's boats in the foreground

- Rules of the Air and International Agreements.
- Landing Fields and Requirements.
- Safety in the Air.
- Commercial Aerial Photography.
- Types of Aerial Cameras.
- Theory of Flight.
- Lighter-than-Air Craft.
- History of the U. S. Air Mail Service
- Equipment of an Aerodrome.
- Organization of a Commercial Flying Co.
- Equipment of a Flying Unit.

Demonstration Flight for All Students

(b) Practical Mathematics:
- Fractions, Decimals and Percentage.
- Measures of Extension, Capacity, Weight and Time.
- Powers and Roots, Ratios, Proportions and Equations.
- Lines, Angles, Polygons, Circles, Solids and Calculations.
- Application of Logarithms, Curves, Plotting and Tables.

(c) Communications:
- Semaphore.
- Morse Code (Buzzing).
- T Popham Panel.

(d) Seamanship:
- Boathandling.
- Knots and Bends and Heaving Lines.
- Boatmanship.
- First Aid.

Mechanics:

ENGINE MECHANICS	21 Weeks
ELECTRICAL COURSE	
BLACKSMITHING COURSE	
AEROPLANE MECHANICS	21 Weeks
INSTRUMENT COURSE	
BOAT BUILDING COURSE	
(Preliminary	8 Weeks)
Total	50 Weeks

The above course of instruction applies to all students at the school. After completion of the above fifty weeks the student is a qualified commercial aeroplane mechanic and receives a general certificate. A specialists' course of nine weeks will be given in any one of the above subjects should it be desirable, in addition, to men specially qualified.

Specialists' Course—9 Weeks

Resume of General Course

Mechanics:

ENGINE MECHANICS:
- Applied Mechanics.
- Overhaul, adjusting and repair.
- Testing, cranking and trouble shooting.
- Installation and testing.
- Advanced Feld Training.
- Bench Work (hand and machine).

BLACKSMITHING:
- Forging and Welding.
- Rough Tool Making.
- Tempering and Annealing.

COURSE FOR ELECTRICIANS:
- Technical Electricity.
- Instruments and Measurements.
- Storage Battery.
- Battery and Magneto Ignition.
- Operation of Motors, Transformers and Generators.
- Starting and Lighting System.
- Telephony, Telegraphy and Radio.
- Advanced Field Maintenance.

AEROPLANE MECHANICS:
- Aeroplane Construction and Repair. (Woodwork; Metalwork; Wirework; Wing-Work; Fuselage Assembly and Alignment; Fabric Work—Work—doping and painting; Propeller Repair).
- Assembly and Alignment.
- Advanced Field Training.

INSTRUMENTS:
- General Practical Knowledge.
- Installation, Adjustment, Maintenance and Repair.

BOAT BUILDING:
- Joining and Cabinet Making.
- Steam Box and Woodbending.
- Caulking and Veneering.
- Pontoon Making (metal and wood).

One week's practical demonstration and maintenance of machine away from her base.

Major W. G. Schauffler, Jr., President
American Airways

Hugh D. McKay, Vice-president
American Airways

T. L. Tibbs, Chief Instructor
American Airways

A Plan to Reduce the Time and Cost of Air Seasoning Wood

In co-operation with the sawmills and wood utilization plants throughout the country, the Forest Products Laboratory, Madison, Wisconsin, is organizing an extensive field study on the air seasoning of wood. This study, it is believed, will be of extreme interest to the lumber manufacturer and to the wood-using industries. The purpose is to determine the piling practice which will result in the fastest drying rates consistent with the least depreciation of stock, the least amount of required yard space, and the least handling costs. The study will be carried on concurrently on both hardwoods and softwoods. All the important commercial woods of the United States will eventually receive consideration.

The air seasoning of wood is an old practice. No systematic attempt has ever been made, however, to work out the exact conditions under which drying time and drying costs can be reduced to a minimum. It is not actually known which of the numberless methods of piling will give the quickest and the cheapest results under given climatic conditions. The new project will furnish a comparison of the effects of such piling variables as sticker heights, the spacings of boards in layers, the heights of pile foundations, and the directions of piling with relation to prevailing winds and yard alleyways.

The study is expected to decide whether from a business standpoint lumber should be dried partly at the mill and partly at the plant of utilization, or whether it should be completely dried at the mill. The data collected will also go a long way toward showing whether air seasoning or kiln drying is the more profitable.

A tentative working plan of the air-seasoning study has been prepared by the Forest Products Laboratory, and copies are being sent to the secretaries of the various lumber and wood-using associations, state foresters, forest school heads, and others eminently qualified to comment on the plan.

Cooperation in the air seasoning study is being offered on every side. As yet the plants at which the work will actually be done have not been definitely chosen, but the extreme interest already manifested indicates that there will be no difficulty in securing cooperation with plants ideal for the study. Actual field work will soon be well under way.

SAFETY FIRST!

THE recent Test carried out on a Sopwith "CAMEL" machine fitted with

IMBER ANTI-FIRE SELF-SEALING PETROL TANKS

again proves the EFFICACY of these tanks in the prevention of FIRE.

ARRANGEMENTS were made as in the previous test to effect a "nose dive," which was brought about under severe conditions.

THE machine was dropped from the Airship R.33 from a height of about 1,500 feet and with the engine running. After the "crash" it was found that the engine, back plate and controls were forced back to the main tank, the cylinders being quite hot enough to vaporise petrol, had the tanks burst. The pilot's seat acted as a buffer, and the blow, in addition to distorting the tank, caused a slight tear of the rubber cover, but there was

NO SPRAY OR LEAKAGE OF PETROL.

IMBER ANTI-FIRE TANKS are the only Government approved tanks, and these tests prove conclusively their superiority over all other Anti-Fire Tanks. No other tank has withstood the test as given to "IMBER," and we CHALLENGE any Anti-Fire Tank Manufacturer to produce a record equal to that claimed by

THE

IMBER ANTI-FIRE TANKS, LTD.,

WEST ROAD, TOTTENHAM, N.17, LONDON, ENGLAND.

Mr. JACK IMBER

of

IMBER ANTI-FIRE TANKS, LTD.

will visit America for two weeks commencing August 21st and will be pleased to meet anyone interested in the purchase of the American patent for the Imber Anti-Fire Tank.

⁂

Address communications to:

Mr. JACK IMBER,
c/o The Mantle Lamp Co. of America,
609, West Lake Street, Chicago.

After September 1st, communications should be addressed:

C/o The MANTLE LAMP Co. of AMERICA
Washington Place, New York.

DIRIGIBLES SUPERIOR FOR FOREST FIRE PREVENTION

Experiments in the use of dirigibles in the detection and control of forest fires and the patrol of National Forests in the vicinity of San Diego will be conducted some time this month. Plans are now under advisement, and it is probable that work will be started within a few days, according to a recent communication from Assistant District Forester R. L. Deering, of San Francisco. It is probable that dirigible B-3 will be used for this purpose. Secretary Henry C. Wallace, of the Department of Agriculture, in his request for co-operation of the Navy, said:

"Sir—The prompt detection of forest fires on the National Forests is one of the big problems of this department and in furtherance of efforts along this line advantage is taken of every possibility of value. The question as to practicability of dirigibles has been presented to me a good many times, but because of the absence of this special equipment and of funds within this department it has not been possible to act on the suggestion.

"I submit for your consideration the suggestion that you authorize the Commandant of the Naval Air Station at San Diego, Calif., to cooperate with the District Forester at San Francisco in experimental use of such equipment at his disposal as you might indicate to determine the practicability of dirigibles in the detection of fires and the patrol of National Forest areas.

"The opportunity for such experiments seems excellent in Southern California because of the existence of the Naval Air Station, extensive National Forest areas within reasonable distance, and the need for intensive patrol because of the prolonged dry season and fire hazard.

"Respectfully,
(Signed) "HENRY C. WALLACE,
"Secretary."

Secretary of the Navy Denby replied in the characteristic manner—by both letter and immediate action, and the Commandant of the 11th Naval District and the Commanding Officer of the Naval Air Station, San Diego, were directed to cooperate insofar as practicable with the District Forester at San Francisco in the experimental use of airships in the protection of forests and patrol of National Forest areas in the vicinity of San Diego, with the proviso that "the Navy's cooperation in this respect is dependent upon the location of the forests to be patrolled and the interference entailed with the operating program of the airships located at San Diego."

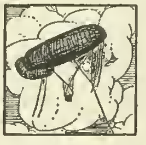
Assistant District Forester Deering is detailing some of his experts to assist in conducting the experiments, which, according to present plans, are to begin "some time early in August."

Local lighter-than-air officers are highly in favor of the practicability of using lighter-than-air craft in National Forest patrol.

Lieut. R. J. Miller, U. S. N., senior lighter-than-air officer, of the San Diego Naval Air Station, points to the dirigible's one great superiority over heavier-than-air craft (in its freedom from immediate forced landing in event of engine failure), as being in itself sufficient evidence of superiority for work of this nature.

"There is no doubt in my mind," said Lieut. Miller, "as to the successful outcome of any experiments in the use of dirigibles in the patrol of National Forests and the detection of forest fires.

"The advantages of dirigibles for this work are manifestly self-evident. First, take the matter of engine failure. The U. S. Army Air Service, in the conduct of its forest patrol, has already lost several lives and a very considerable number of aeroplanes as a result of forced landings in mountainous, timbered country, as a result of engine failure. This danger is practically eliminated with lighter-than-air craft. Engines do of course have their troubles in dirigibles, though not nearly as much as in heavier-than-air craft, due to the fact that they operate at much slower R.P.M., and the wearing stress and strain is reduced accordingly. But even granted complete engine failure, the dirigible pilot can 'free-balloon' his craft until repairs can be accomplished, or in event repairs are impossible, he can pilot his ship by air currents and the use of sand ballast and gas release valves to a point where safe landing could be made. Second, in the control of fires the dirigible could hover in the vicinity of such fires at a safe distance and a forest ranger-observer could direct his forces, either by dropping message bags, by radio in connection with portable ground outfits, or even by oral communication with megaphone."



FOREIGN TECHNICAL DIGEST

The New Henry Potez Aeroplanes

The Henry Potez, type VIIIR, is a sporting two-seater aeroplane, fitted with one Le Rhone engine developing 80 h.p. The seats are side by side, and the undercarriage, as shown in the photograph, is of unusual type.

Specification

Span	25 ft. 3 in.
Length	19 ft. 4 in.
Height	8 ft.
Total area	204 sq. ft.
Weight, empty	661 lb.
Useful load	507 lb.
Total weight	1,168 lb.
Duration	3 hours.

The Henry Potez, type IX, is a commercial plane for four passengers, with a water-cooled Lorraine-Dietriech engine of 370 h.p., with two Lamblin radiators mounted under the fuselage between the spares of the undercarriage. Aeroplanes of this type are used by the Compagnie Franco-Roumaine de Navigation Aérienne for the Paris-Strasbourg-Prague-Warsaw air line.

Specification

Span	42 ft. 7 in.
Length over-all	32 ft. 6 in.
Height	10 ft. 6 in.
Total area	474 sq. ft.
Weight, empty	2,435 lb.
Useful load	1,610 lb.
Total weight	4,045 lb.
Duration	5 hours.
Maximum speed	127 m.p.h.
Economical speed	111 m.p.h.

Aeronautics, July 21, 1921.

The Latham Flying-Boat

M. Latham recently built a commercial flying-boat that is a development of the naval flying-boats Latham used during the war. The engines are four Salmson engines of each 250 h.p. mounted in tandem in two "eggs." There are four airscrews, two tractor and two propeller. With full power the maximum speed is 101 m.p.h., and the range is 500 miles, endurance being 5 hours. Economical speed is 80 m.p.h., endurance being then 8 hours and radius of action 621 miles.

Following is the general specification of the last mode Latham flying-boat:

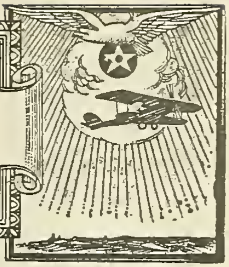
Span upper plane	104 ft.
Span lower plane	78 ft.
Total height	16 ft.
Total length	60 ft.
Total area	1,940 sq. ft.
Weight, empty	9,810 lb.
Useful load	6,060 lb.
Total weight	15,870 lb.
Total horse-power	1,000 h.p.
Load per sq. ft.	8 lb.
Load per h.p.	15 lb.
Horizontal speed at ground level	101 m.p.h.
Horizontal speed at 3,000 ft.	100 m.p.h.
Horizontal speed at 6,000 ft.	97 m.p.h.

Climbing speed, 3,000 ft. in 8 min.; 6,000 ft. in 19 min., 9,000 ft. in 30 min.—*Aeronautics, July* 28, 1921.

High-Altitude Meteorological Service by Wireless

Meteorological bulletins for aeronautical purposes, prepared by the High-Altitude Meteorological Department of the Prussian Aeronautical Observatory at Lindenberg, are now spread by wireless from the Königswusterhausen Radio Central Station by a 3,200-meter wave (undamped) at the following times: 6:50-7 a. m., 10:40-10:50 a. m., 5-5:10 p. m., 9:15-9:25 p. m. Each of these bulletins comprises: (1) A résume of high-altitude data as derived from pilot and captive-balloon ascents as well as aeroplane observations, and expressed in a special code; (2) a summary of barometer readings over the whole of Europe; (3) weather bulletins for Central Europe; (4) a prognosis for Central Europe, special regard being taken to the requirements of aeronautics.

NAVAL *and* MILITARY AERONAUTICS



Navy Bureau of Aeronautics Formed

Washington.—A general order formally establishing the Bureau of Aeronautics of the Navy Department was made public August 11 by Acting Secretary of the Navy Roosevelt.

While Rear Admiral W. A. Moffet is director of naval aviation, he served in the office of naval operations until the order was issued. Under the new arrangement all activities pertaining to naval aviation will center in the Bureau of Aeronautics.

Heretofore these activities have been scattered through several bureaus. The Bureau of Construction and Repair handled construction matters, the Bureau of Engineering looked after aviation engines, and various other bureaus had a hand in the flying activities of the navy.

In response to a strong plea by Secretary Denby, Admiral Moffet and others, Congress made provision in the Naval Apropriation Bill for the current fiscal year for the creation of a separate Bureau of Aeronautics, which is considered a very important change for the better by flying men and by naval officers in general.

The Bureau of Aeronautics will continue subordinate to the office of naval operations, but only in the sense by which other bureaus are subordinate to that office and the several branches of the army are subordinate to the General Staff.

Naval Constructors who have specialized on aviation will be transferred to the Bureau of Aeronautics and specialists in other bureaus who have been devoting their time and talents to flying likewise will be switched from their present bureaus to the new organization.

That much better opportunity for development and improvement will be possible with all air matters centered in a single bureau is conceded on all sides. Yet a good deal of pulling and hauling were required to get the authorization through Congress. While giving the navy a Bureau of Aeronautics, however, Congress actually reduced the appropriations for naval aviation below those of last year, which were insufficient. It is believed possible to make a better showing with the reduced appropriation under centralized control than if they were disbursed through several bureaus.

Maj. Fisher C. O. Airships

Major Fisher has been placed in command of the Lighter-Than-Air Section of Langley Field. Major Fisher relieves Major Paeglow, who returns to his former station as Commanding Officer of the Balloon School at Lee Hall, near Camp Eustis.

The North Island Controversy

So far, efforts to settle the question of joint ownership of North Island have been fruitless. A joint hearing of Secretaries Weeks and Denby has been arranged by the naval committee for last Monday, but, owing to the repeated demands from the House for the presence of members during the tariff debates, it was decided to postpone the hearing until after the tariff bill had been passed.

A bill, introduced by Representative Swing, was referred to the naval committee, to authorize the Secretary of the Navy to acquire 1,000 acres, more of less, at or near Camp Kearney, Calif., for a site for a lighter-than-air aviation station. It reads.

"That the Secretary of the Navy be, and he is hereby, authorized to acquire 1,000 acres, more or less, at or near Camp Kearney, Calif., for a site for a lighter-than-air aviation station, and to pay for the same an average price of not exceeding $100 per acre."

War College Remains at Newport

The proposition to move the Naval War College from Newport, R. I., to Washington, has been disapproved by Secretary of the Navy Denby. This action had been strongly urged by former Secretary Daniels. This action was taken principally for the reason that Mr. Denby was disinclined to incur expenditures by disturbing existing conditions. It is expected that the House Committee on Naval Affairs will allow the bill (H. R. 2491) to die in committee.

Roma Arrives at Norfolk

The long-looked-for "Roma" semi-rigid airship, purchased by the government for use of the Army Air Service, has at last arrived!

With the arrival of the big ship aboard the U. S. S. Mars Major Fisher, Commanding Officer of the Lighter-Than-Air Division, immediately left for Norfolk to make the necessary arrangements for the transfer of the ship to its home base, Langley Field.

It is planned to transport the various parts of the ship on barges across Hampton Roads to the Airship dock at Langley Field.

It is said that some time will be required in the work of assembling and setting up the mammoth dirigible.

Reductions in Personnel at San Diego

In accordance with general reorganization plans, the San Diego Station will, in the very near future, cease to exist as a Naval Air Station (insofar as flight operations are concerned), and become a repair and operating base for the Air Force of the Pacific Fleet. Though the change comes at a time of general curtailment of operations throughout the Navy, necessitated by reduced appropriations, the plan of reorganization is one that has long been under consideration.

The fleet air force is, and very evidently should be, the active center of all flight operations for Naval aviation. As the dreadnaughts, battleships, destroyers, et al., of Uncle Sam's surface fleets require home ports, Navy yards, repair bases, etc., so modern air fleets require adequate operating bases, repair bases etc., and the Naval Air Station at San Diego, with its steel and concrete buildings, modern ships and hangars, is surely the logical base for aircraft operations on the Pacific Coast.

Contrary to expressed belief of some of those who have helped make the Naval Air Station what it is today, operations will not be diminished—rather reorganized, systematized in line with new plans, and intensified. Station flying operations and the Station personnel engaged in the activities connected solely with flight will doubtless be transferred elsewhere. Work in the erection and test of both land and water planes (principally the former), and in the major overhaul of engines and aircraft of the Fleet Air Force will go merrily on. The development of the Station, be it called Air Station, repair base or what not, will continue as heretofore. Systematized, concentrated effort — efficiency! That is the watchword of the Navy today, and the present changes are in line with this policy.

Turn Indicator Being Used

Attention has recently been called to the value of the Turn Indicator for flying in bad weather, through the flight of Lieut. VanZandt of the Air Service from Moundsville, W. Va., to Washington in the fog in a DH-4B, and of Mr. Bruce Eytinge's flight from Philadelphia to Washington in a BaCo "Skylark" under similar conditions, both of which were described in Aerial Age.

These instruments have now been developed by the Pioneer Instrument Company to a point where they are available for commercial use, and may no longer be considered to be experimental.

Having completed a large quantity of Turn Indicators for the Navy Department, who adopted the Pioneer Turn Indicator after extensive tests on several different types, the Pioneer Company now has a stock of these instruments ready for immediate shipment on commercial orders.

Aircraft and Lightning

An experienced flier discusses the possibility of aeroplanes in flight being struck by lightning during a storm in a recent issue of *Illustrierte Flug-Welt*. His remarks are based on some 70 flights under such circumstances and on general principles. He shows that no danger is to be expected in the first place if the machine is not in the direct line of the discharge, and in the second place, even if it is, it is not likely from the nature and distribution of the conducting metal portion that danger due to fire will arise. Out of 30 cases where the machine was struck directly, the writer maintains that there were no evil effects, while in all known cases in Germany where a machine fell during a storm there was no evidence of scorching of parts or melting of metal.

FOREIGN NEWS

Stockholm-Reval Air Service

A new passenger and baggage air service has been opened between Stockholm and Reval. Machines leave Stockholm on Tuesdays and Fridays at 10.30 a.m. Swedish time, arriving Reval three hours later. The return journeys are made from Reval at 4 p.m. the same days. Passenger fares are 250 crowns Swedish, whilst baggage in excess of 15 kilos is charged at the rate of 5 crowns per kilo.

Argentine Height Record

A new height record was established in the Argentine on June 10 by the military pilot, Sargento primero Barrufaldi, a short time after the record of Pilot Olivero.

With a 300 h.p. Bristol machine Pilot Barrufaldi ascended up to 7,400 metres, carrying as passenger his mechanic, Luis Fossatti.

Acceleration of Morocco Service

The weekly air post from Toulouse to Casablanca (1,050 miles) will in future make the journey from France to Morocco in one day.

A trial trip of the accelerated service was made recently. The mail plane started from Toulouse, with bags which had just arrived from Paris, at 5 a.m., and after stopping at Barcelona, Alicante, Malaga and Rabat, reached Casablanca at 7 p.m. the same evening.

International Aviation Meet on Lake Garda for the Gabriele D'Annunzio Cup

The international aviation meet on Lake Garda for the Gabriele D'Annunzio cup will take place on Lake Garda during ten days of September, 1921, the date of beginning not yet announced.

Prizes to the amount of Lire 100,000 will be awarded.

(a) General Regulations.—The meet is reserved only for contestants belonging to allied or neutral countries. Contestants belonging to ex-enemy countries (late war, 1914-1918) will not be allowed to compete.

(b) The present regulations are drawn up and the competition will be carried out in accordance with the rules laid down in the "Regulations of the International Association of Motorboat Races" so far as the motor boats are concerned, and as prescribed by the "General Regulations of the International Aeronautic Federation" and by the "Italian National Aeronautic Federation" (Aero Club of Italy) so far as seaplanes are concerned (in this report the term "seaplane" includes flying boats).

(c) The contest will take place on Lake Garda in the month of September, the date of beginning to be announced later.

(d) The prizes are as follows:

I. Motorboat races, cash prizes amounting to Lire 50,000.

II. Seaplane races, cash prizes amounting to Lire 30,000, and the D'Annunzio cup valued at Lire 20,000.

Special Regulations governing the seaplane competition:

All contests for seaplanes will take place over circuits A, B, C and C bis, with the exception of any modifications specially mentioned hereafter:

Circuit A: Circuit of the South—Desenzano, Sirmione, Bardolino, San Vigilio, Maderno, Gardone Riviera, Salo, Isola, Desenzano. Departure and arrival at Desenzano; one lap, 50 km.

Circuit B: Circuit of the North—Riva, Gargano, Maderno, Gardone Riviera, Salo, Isola, San Vigilio, Torri, Malescine, Torbole, Riva. Departure and arrival at Riva; 1 lap, 100 km.

Circuit C: Circuit of the Lake—Gardone Riviera, Salo, Isola, Desenzano, Sirmione, Bardolino, San Vigilio, Torri, Malcesine, Torbole, Riva, Gargano, Maderno, Gardone Riviera. Departure and arrival at Gardone Riviera; one lap, 125 km

Circuit C bis: Gardone Riviera, Salo, Isola, Desenzano, Sirione, Bardolino, San Vigilio, Isola, Salo, Gardone Riviera, Maderno-Toscolano, Malcesine, Riva, Gargano, Maderno, Gardone Riviera. Departure and arrival at Gardone Riviera; one lap, 150 k.m.

Qualifications and Entries: The definition of seaplanes as per the regulations of the Monaco Aviation Meet, April 13-30, 1921, has been adopted for the international aviation meet on Lake Garda. The types of seaplane which may enter the contest are as follows:

First Series—Weight-carrying seaplanes, Schneider cup type, 1920. Carrying 200 kg. of commercial load.

Second Series—Speed seaplanes, Monaco type, 1921. No commercial load.

Seaplanes will not be permitted to take part in any of the events of the program unless they have previously made a trial altitude flight in the presence of the Sporting Commissionaires of 3,000 meters in less than an hour for those of the first series (weight-carrying), and of 2,000 meters in less than 45 minutes for the second series (speed). These contests must be carried out on the first day of the meet.

Aviation Progress in the Republic of Honduras

Aviation is rapidly progressing in the Republic of Honduras. The Bristol machine that reached Honduras last April, the first aeroplane to fly in this country, has made many successful flights over and around the city of Tegucigalpa.

An aviation comittee has been created to interest prominent people in the formation of a corporation which will devote itself to commercial aviation between the capital and the interior cities. The whole country has answered the call, and it is expected that before the end of the year five or six machines will be brought over to be placed on a regular passenger and mail service, and also for the transport of small freight.

The Government has sent two young Honduraneans to the United States to study aviation. A flying academy is now in course of creation and will soon be opened and ready to start teaching all things pertaining to aeronautics.

It will be well to mention the great step given by the Minister of War and Navy, Dr. Carlos Lagos, towards the fostering of aviation in Honduras. On the 14th July Minister Lagos issued an order of the day suggesting that all officers and men of the Honduranean army and all persons connected directly or indirectly with the department of war and navy give one day's (the 14th of July) salary to the Aviation Committee as a contribution towards the purchase of several flying machines. The army answered with enthusiasm that all officers and men would gladly give their salary on that day to the Aviation Committee. This means many thousands of dollars towards the aviation fund.

Minister Lagos is a prominent lawyer and a General of the Honduranean army; he is also the brother of Mrs. Anita Lagos de Lopez Gutierrez, wife of the President of the Republic. General Lagos' influence is therefore most important and his assistance very valuable. He is a great believer in progress and thinks that aviation must be introduced in Honduras both for official and for commercial purposes.

The well-known review, "Renacimiento," one of the leading publications in Central America and the pioneer in aviation propaganda in Honduras, has been conducting a most enthusiastic campaign pro-aviation, and the results of its efforts are beginning to be felt in Honduras.

On the 15th September next,—Centenary of Central American Independence,—the aeroplane now in Government service in Honduras will make a flight over the whole Central American Isthmus, starting at San Jose, capital of Costa Rica, then calling at Managua, capital of Nicaragua, then San Salvador, capital of Salvador, Guatemala, capital of Guatemala, and ending at Tegucigalpa, capital of Honduras.

Aviation in South Africa

By Lieutenant-Colonel Vicomte Rene de Sarigny, O.B.E.

It is particularly unfortunate that in a country like South Africa, where distances are so great, railway transport so slow, climatic conditions so good and landing grounds so plentiful, that aeronautics have had little or no support.

The history of aviation in South Africa can be written in a very few words.

The pioneers of commercial flying were The South African Aerial Transport Company, Limited, and Handley Page (South Africa), Ltd.

Both these companies started operations with unsuitable machines, except for "joy riding." The Transport Company used Avros and Handley Page used their own heavy type twin engine busses.

Both companies went into liquidation during their first year of operations and ceased to exist.

Later there was started the Ross-Thompson Aviation Company, who operated all over the country, with headquarters in Johannesburg.

They have 110-h.p. Le Rhone Avros.

Captains Ross and Thompson—ex-officers of the Royal Air Force—are the proprietors.

In the Cape there is the Solomon Bros. Company. I believe they fly D.H.-6 type machines.

In Natal, Captain Mail is at work, also D.H.-6's and in the East London district Major Honnett operates with Avros.

All these gentlemen are well-known and keen aviators, who are doing great work in a small way—joy riding commercially—instilling into the public mind the safety of flying and wearing down the public prejudice against aviation. But there is no Government support for them and until a large company commences work on a business footing, using large machines capable of carrying about a dozen passengers, starting regular services at regular times at non-prohibitive fares, aviation in South Africa will remain backward. The pity of it.

The possibilities of a company succeeding are so great, yet the only thing that stops its progress is the usual want of capital. The enormous wealth of this country is in the hands of a few—very few. Mine magnates and commercial gentry will not invest in the air.

A "speculation" company open to public subscription becomes oversubscribed before the prospectus is out of the hands of the printers, whilst an aerial company does not raise sufficient interest to pay the printer for the prospectus.

Johannesburg (the hub of South Africa) to Capetown (the Parliamentary capital) is 1007 miles and takes 48 hours in an uncomfortable, narrow-gauged and unpunctual railway train. The same journey—but by air—could be done in a decent single-engined ten-seater machine in about 8 hours.

Johannesburg to Durban by train, 519 miles, takes 23 hours, and by air 3½ hours—and so on.

Recollecting the words of the late Jimmy Leonard, "There are more brains to the square inch in South Africa than in any part of the world,' one wonders how so great and famous and clever a barrister could be so mistaken.

And now the Government have inaugurated a Defence Air Force. But no subsidy for commercial flying.

Still there is a ray of hope.

An attempt is being made to float a company in London with a capital of £500,000. Its style is African Aerial Travel and Transport Company, Ltd. The board will be in London with an advisory board in South Africa, consisting of the writer hereof and other gentlemen.

The whole scheme has been carefully and well framed, provisional contracts entered into with all the leading merchants regarding the conveyance of parcels, and now is only waiting for the capital required to be subscribed before operations will be commenced and there is no doubt it will be a great dividend paying enterprise.

It is proposed to use Spad-40 machines, built by Messrs. Bleriot—the engine being the Napier Lion, 450-h.p. This type carries 10 passengers, pilot and mechanic, and has a cruising speed of 120 miles an hour.

Captain Victor Kelly is at present in England regarding the raising of the necessary capital, and during his absence arrangements are being made with the various municipalities to grant sites for aerodromes.

The Government has been approached with a view to their providing wireless receiving stations and each machine will be fitted with wireless telephony.

Messrs. Ashuret, Morris, Crisp & Co., the well-known London firm of solicitors are the representatives in England.

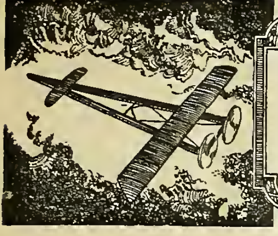
An interesting test was recently carried out in Johannesburg by the Ross-Thompson Aviation Company, Captain Ross flying an Avro using the new local invention, "Penrol."

This is alcohol treated with acetylene.

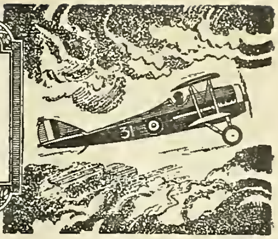
The test was eminently satisfactory, the engine starting first pull over of the prop. In the air the rev. counter maintained a steady 1100 revolutions and after flying for some time it was pointed out to the technical gentlemen present that the cylinders were extraordinarily cool, and the nose plate, which as a rule gets very hot when petrol is used, was hardly warm.

A company is at present being floated called Penrol (South Africa), Ltd., to place the new fuel on the market in this country, and it is the intention of the directors to register companies in various other countries at an early date.

The efficacy of the fuel has been proved beyond doubt by all the leading motor firms, and it will come as a God-send to aviation companies, as the petrol bill will be reduced by more than half.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Propeller Blade Outline

BLADE outline is the most conspicuous feature of a propeller, the thing which first attracts the attention of an observer —whether the blade is wide or narrow, straight or curved, square or round at the tip, etc. While this particular feature attracts the most attention it is actually one of the less important characteristics in the general run of designs. This is borne out by the fact that nearly every possible shape of blade has been made and used with more or less successful results. Only a relatively few designers can explain in what respects the blade shapes selected by them produce any different or better results from the forms chosen by other designers.

Were it not for the bending and twisting of the blade, one blade outline would be found to equal any other of the innumerable blade forms seen on various types of aircraft. When we take into account this bending and twisting, the necessity for carefully planning the outline so that it will bend or twist in a manner predetermined by its designer, is an obvious conclusion. Therefore if the designer desires that the blade shall be as rigid and unyielding as possible, he will select a form having the simplest and straightest lines, with practically constant increase in width and thickness from tip to hub. The designer will also avoid all decided curves or bends and all abrupt changes of form or dimension.

On the other hand, should the designer instead of endeavoring to eliminate all flexure or torsion of the blades, desire to take advantage of these tendencies, it is possible for him to lay out the blade with such a contour that the inevitable bending under thrust will be accompanied by a slight decrease of blade angle and a consequent reduction in pitch. This design then becomes a flexible and more or less variable pitch propeller in which the pitch changes with the twisting or torsional action of the blade under every change of pressure.

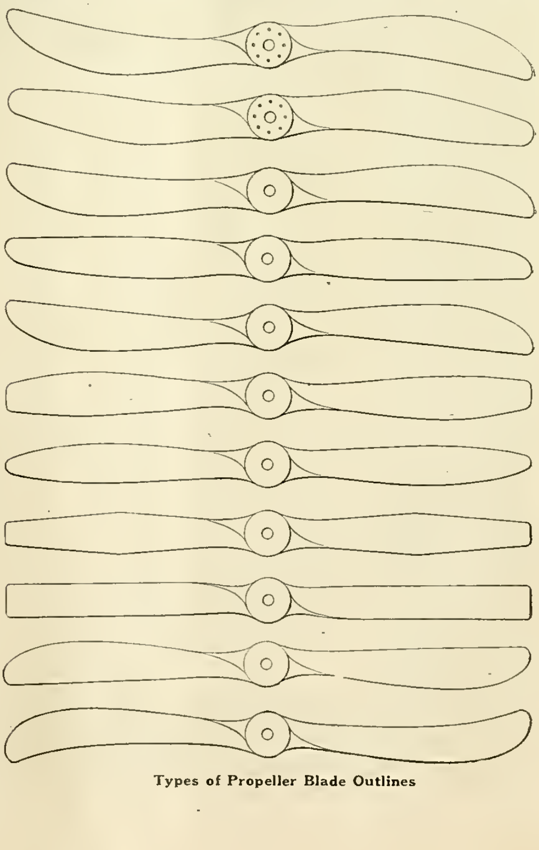
These two radically different types are shown among the outlines given below. The propeller at the top of the illustration is one of the Paragon designs, having torsional flexing blades. The outline below it is one used extensively by the Government during the war; it has the variable pitch feature to a certain degree. Third from the top, the design is, in a general way, similar to the first mentioned except that the blade is curved only so far as necessary to give stability of pitch and avoid all tendency to "flutter." Below it is shown the rigid type of propeller, possessing strength and stability—a straight, simple, clean design. Next is shown the type developed by the French designer Chauviere from whom it takes its name. It is also known as the "Integrale" from the trade name under which it was made. Sixth from the top, the blades with squared tips are frequently seen on European aeroplanes. The type below it, with evenly tapered blades, is one designed on the theory that the centers of gravity of the blade sections should be in a straight line. They were used on the Fokker planes.

One of the navy types is shown in the illustration fourth from the bottom; it has the merit of simplicity of form and convenience of manufacture. Below it is shown the "Normale" used by the French Regy brothers, and having a considerable vogue during the pre-war period. Next to the bottom we have a design which, in outline, is almost the exact reverse from the third one on the list. It has been used a great deal in Europe, but to only a limited extent in the United States. The blade outline at the bottom of the illustration is one of a rather unstable type but which can be successfully used where the engine power is low or where the blade is of exceedingly rugged construction for the duty it must perform.

Rigid types have their best application in connection with craft or machines in which there is continuous heavy duty nearly constant in character, as on heavy seaplanes, dirigibles, etc. The flexible variable pitch propellers have their most efficient application on the relatively small and higher speed machines, such as speed scouts, machines for trick and acrobatic stunting, scout seaplanes designed to fly from the decks of ships, etc. Their employment is desirable whenever there are wide variations in the speed and head-resistance of the machine and where very high initial thrust, as compared with the normal flying thrust, is an essential requirement.

Flexing propellers are designed on the principle that the blade should constantly bend and that the bending of the blade should be accompanied by a torsional or twisting action by which the pitch would automatically change to accommodate the propeller to favorable action with every change or fluctuation of conditions affecting it. In plan view the blade retreats toward the trailing edges in a continuous curve from hub to tip. With this shape of blade the centers of pressure of the sections lie about one-third the blade width from the leading edge. From this positioning of the centers of pressure comes the result that any increase of pressure on the blade causes it to flatten out and reduce its pitch momentarily or during continuance of the increased pressure. Similarly, any decrease of pressure permits the blade to twist in the opposite direction and increase the pitch.

As the thrust on a propeller is at all times equal to and opposite the head-resistance of the aeroplane, there are necessarily great variations of pressure on the propeller under the different conditions of flying, such as in starting, climbing, flying level, and in the various stunting manoeuvres. The heavy resistance to starting or climbing puts a correspondingly heavy pressure on the blades. This flattens them out with a reduction in pitch that allows the engine to go up to full speed and power and get the maximum thrust with the low pitch propeller.



Types of Propeller Blade Outlines

A-E-R-O-N-I-T-I-S

The Aerial Age

We are now in the aerial age,
  Ruled by the air sign Aeries.
When flying comes upon the stage,
  According to the prophecies.

* * *

Most every one that has flown,
  Women, children or men.
Say flying is coming into its own,
  And want to fly again.

* * *

'Tis getting safer every day.
  To travel through the air
And aeroplanes are here to stay,
  Flying in bad weather or fair.

* * *

Many gave up their lives that flew,
  As pioneers of aviation.
The same as in all things new,
  Why should that kill its reputation?

* * *

Cause street cars and trains are wrecked,
  And ships sink beneath the waves.
Cause roads with wrecked autos are bedecked,
  Is that the sign they're not safe.

* * *

They're now flying all over the earth,
  From continent to continent.
And aeroplanes prove their worth,
  Wherever they are sent.

* * *

Their practicability has been awaited,
  To carry passengers and freight.
And now they are with the auto rated,
  And we see the railroads fate.

* * *

Battles on land and sea, have been won,
  By aeroplanes the aerial eye.
By giving range, etc., to guns,
  While they were on the fly.

* * *

Pictures are being taken from the air,
  Moving pictures and bird's-eye views.
Our forests are watched for fire flares,
  From aeroplanes who wireless the news.

* * *

Health flights for convalescent patients,
  Are now being taken every day.
'Tis the greatest boon to all nations.
  The greatest specialists say.

* * *

They're flying over mountains and deserts,
  Cliffs and volcanic craters.
Across the sea they soar like birds,
  Faster than any auto racer.

In Asia they have discovered
  Ancient lost cities from the air.
Over the pyramids they have hovered,
  And gained information rare.

* * *

Never was there such activity shown,
  As there is in the flying game.
In a few years it has tremendously grown,
  And made itself a big name.

* * *

'Tis a new industry with possibilities vast,
  And a future bright and glorious.
And it is agrowing so very fast,
  And considered by the serious.

* * *

Later they'll use power direct from the air,
  And fly a thousand miles an hour.
They'll travel high in atmosphere rare,
  With unlimited radius and power.

* * *

They'll rise in the air straight from the ground,
  And stand still wherever they care.
They will travel at ease without a sound,
  These coming ships of the air.

—*Henri T. Haller.*

Far above the restless ocean,
  Far above the rocky shore;
Elements in mad commotion,
  Beneath the cloudland where I soar:
Gliding through fleecy clouds,
  Cool, damp and soft,
Then with a Falcon spurt,
  Swing high aloft,
Breaking through the bank of clouds,
  To purple skies I rise,
Enveloped in a rainbow mist,
  From gorgeous evening skies.

—*Paul Xavier.*

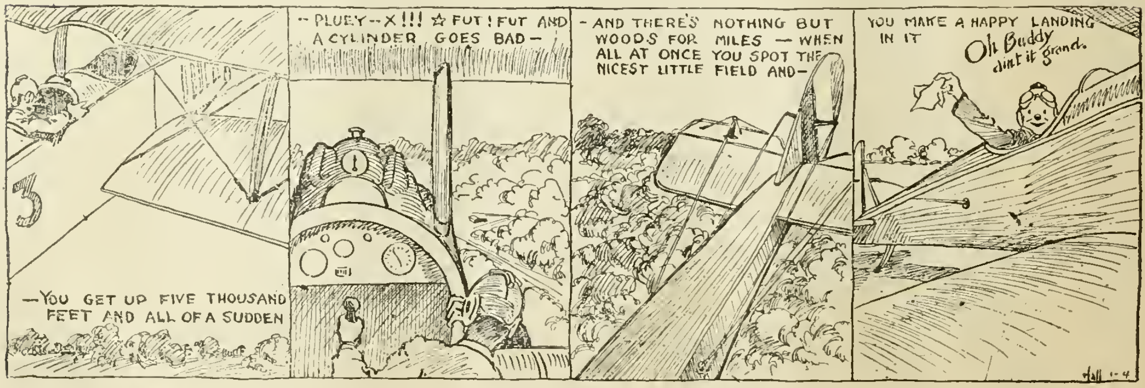
I

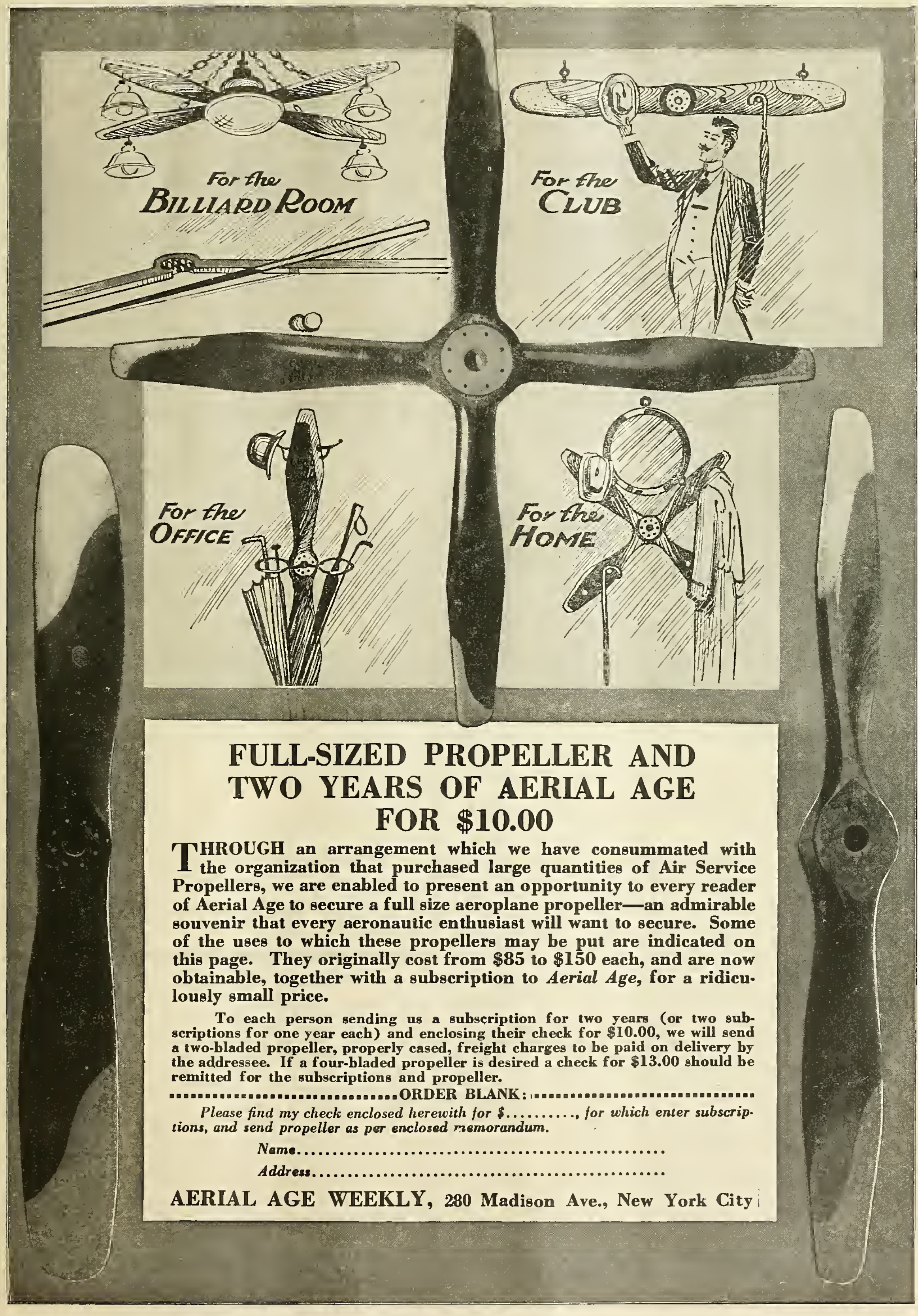
There was a young Pilot both skillful and daring,
  Who fell deeply in love with a sweet little Jane;
He even quit drinking and smoking and swearing,
  And almost forgot all about his good Plane.

II

One day he was flying high up in the sky,
  And dreaming of winning sweet Jane by and by,—
He said to himself, "I will hug her this how;"
  He came to with his arms 'round the neck of a cow.

—*Paul Xavier.*


3
—YOU GET UP FIVE THOUSAND FEET AND ALL OF A SUDDEN
— PLUEY — X!!! ☆ FUT! FUT AND A CYLINDER GOES BAD —
— AND THERE'S NOTHING BUT WOODS FOR MILES — WHEN ALL AT ONCE YOU SPOT THE NICEST LITTLE FIELD AND—
YOU MAKE A HAPPY LANDING IN IT
Oh Buddy aint it grand.
Hall 1-4



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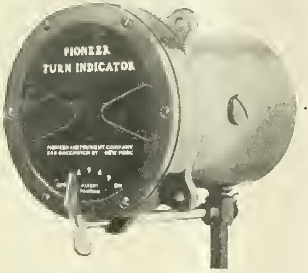

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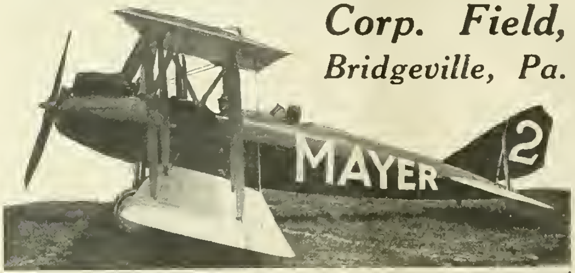

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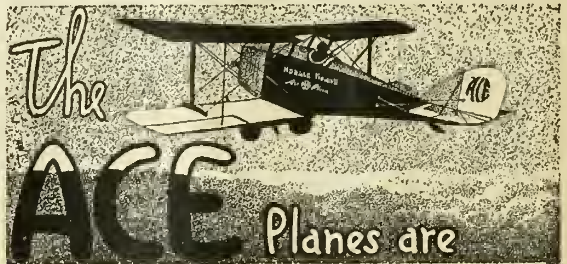

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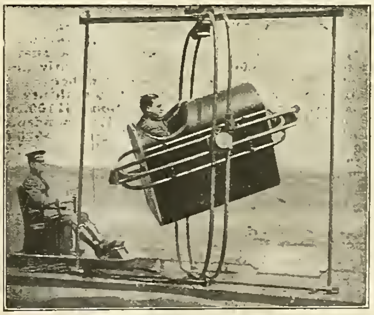

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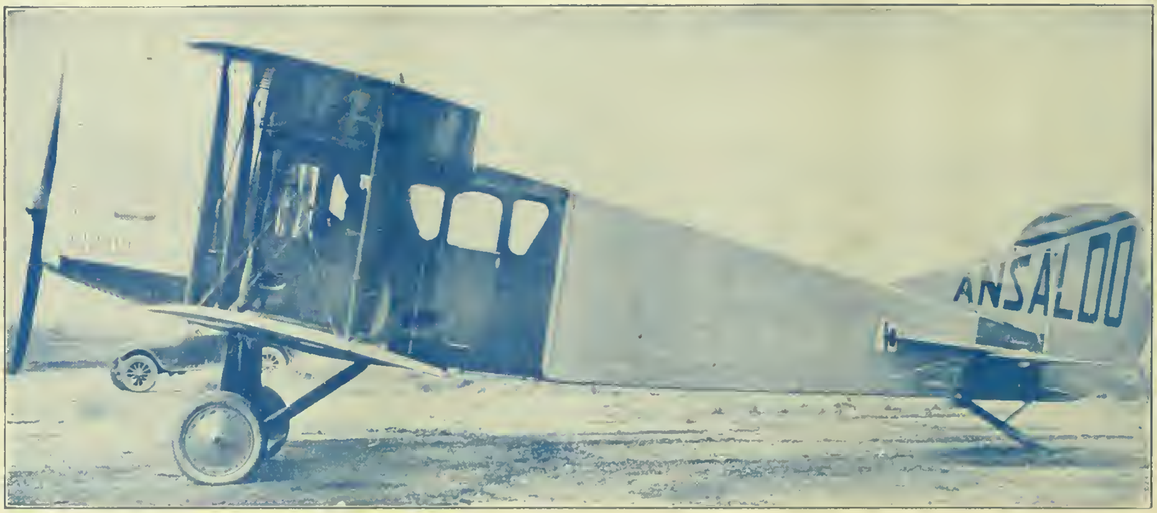

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VOL. XIII, No. 25

TABLE OF CONTENTS

Army and Navy Board Reports on Bombing Tests 583
The News of the Week 584
Manufacturers Aircraft Association Request Co-operation 585
The Aircraft Trade Review 586
The Distant Compass 587
Kodaking from an Aeroplane 589
Experimental Reinforced Plywood Truss Ribs 591
Naval and Military Aeronautics 595
Foreign News 596
Elementary Aeronautics and Model Notes 597
Aeronitis 598

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THE STATES OF NEVADA AND NORTHERN CALIFORNIA	**Earl P. Cooper Airplane & Motor Corporation,** Sutter & Gough Sts., San Francisco, Calif.
THE STATE OF NEBRASKA	**Grand Island Aero Company,** Grand Island, Nebraska.
THE STATE OF WISCONSIN AND UPPER PENINSULA OF MICHIGAN	**Curtiss Wisconsin Airplane Company,** 330 Clinton St., Milwaukee, Wisc.
THE STATES OF NEW MEXICO, UTAH, WYOMING, AND COLORADO	**Curtiss Humphreys Airplane Company,** 1st Nat'l Bank Bldg., Denver, Colo.
THE STATES OF PENNSYLVANIA, MARYLAND, DELAWARE & SOUTHERN NEW JERSEY	**Curtiss Eastern Airplane Company,** 130 S. 15th St., Philadelphia, Penna.
THE STATES OF MINNESOTA, THE DAKOTAS, AND MONTANA	**Curtiss Northwest Airplane Company,** 707 Metropolitan Bank Bldg., Minneapolis, Minn.
THE STATE OF KANSAS AND PART OF MISSOURI	**Williams & Hill Airplane Company,** Arkansas City, Kansas.
THE NEW ENGLAND STATES	**Curtiss New England Airplane Company,** Garden City, Long Island, N. Y.
THE STATES OF TEXAS, OKLAHOMA, AND UNASSIGNED TERRITORIES	**Curtiss Aircraft Corporation,** Garden City, Long Island, N. Y. Love Field, Dallas, Texas.
ALL COUNTRIES OF SOUTH AMERICA	**C. W. Webster,** Curtiss Aeroplane & Motor Corporation, Garden City, Long Island, N. Y.

DEALERS

THE STATES OF MASSACHUSETTS AND RHODE ISLAND	**Lynnway Aerial Transportation Company,** 7 Central Square, Lynn, Mass.
PARTS OF THE CAROLINAS	**H. L. Morrow Company,** 540 S. Tryon St., Charlotte, N. C.

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

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ARMY AND NAVY BOARD REPORTS ON BOMBING TESTS

THE report of the joint board of the army and navy on bombing tests off the Virginia capes must remind the layman of the problem of the conflict between the irresistible force and the immovable object.

One of the questions which the tests were to answer was whether the bombing plane, in its present state, was a generally adequate weapon against the battleship of today. To this question the report says, No; not unless the plane is operated from a land base:

"No planes large enough to carry a bomb effective against a major ship have been flown from or landed on an aeroplane carrier at sea. It is probable, however, that future developments will make such operations practicable."

What of the bombing plane as an instrument of coast defense, operating from the shore? On this point the plane scores:

"Aircraft carrying high capacity high explosive bombs of sufficient size can sink or seriously damage any naval vessel at present constructed provided such projectiles can be placed in the water close alongside the vessel."

Can battleships be made invulnerable against aerial attack? Only through the ship's offensive defense, the board indicates, for it says that "it will be difficult, if not impossible, to build any type of vessel of sufficient strength to withstand the destructive force that can be obtained with the largest bombs that aeroplanes may be able to carry from shore bases."

So if the United States had enough planes of sufficient capacity no invading fleet could reach our shores unless the enemy ships were equipped with anti-aircraft guns so marvellous as to bring down all our fliers.

As the report remarks, the development of aircraft "has but added to the complexity of naval warfare." It has not junked the battleship, for that must be kept to protect the nation against a blockade. It has rendered it necessary to make the battleship a carrier of planes and to equip it with more and more powerful anti-aircraft guns. Meanwhile the planes must be made bigger, faster and their locating instruments more accurate.

The report does not doom capital ships, but it is for all that a victory for the advocates of the plane as a tremendous weapon in coast defense. The United States could have, within a year and at comparatively small cost, a squadron of bombing planes that could fly from a shore base and destroy any battleship that came within gun range of the coast. That's a comfort to know, however the scientific duel between the builders of dreadnoughts and the makers of planes may result in future.

There are naval officers in England and America who think with Admiral Sir Percy Scott and Brig. Gen. Mitchell that submarines and aircraft have rendered the capital ship obsolete. If so, a nation that spent millions chiefly on aviation and maintained a fleet of swift carriers would be a more terrible enemy than a power that placed its dependence upon capital surface ships and neglected aviation. Granting that surface ships are necessary to a navy for police duty in time of peace and for offense and defense in war, it would be judicious not to have too much faith in them. Senator King of Utah said a sound thing when he declared that "these tests demonstrated the vulnerability of the battleship and demonstrated that while it is not obsolete as the principal unit of the fleet its strength and influence have been greatly impaired."

While exceptions may be taken by advocates of the airship as a superior unit to some of the reasoning of the Joint Army and Navy Board's report, it is an honest and courageous summing up of the case by men who felt their responsibility. Speaking of the navy alone, its aviation strength must be expanded to the dimensions of a fleet in the air, which of course will require time, and a sufficient number of swift carriers must be provided. But this will take money—a great deal of it. In the present state of the country's finances the naval appropriations cannot be increased. Will not Congress have to choose between neglecting aviation, which would be blindness to the lesson of the bombing tests at sea, and calling a halt upon the three-year capital ship program somewhere, so that money to be spent upon it could be diverted to the expansion of naval aviation?

THE NEWS OF THE WEEK

Loening Hydro-Monoplane Breaks Altitude Record

A Loening monoplane broke the altitude record for hydro machines August 16 when it reached a height of 19,500 feet at a test conducted by the Aero Club of America at Fort Washington, L. I. The instruments were sealed at the beginning of the flight by L. D'Orcy of the club, and when read at the club house, No. 11 East 38th Street, showed the previous record of 9,603 feet had been broken by nearly 10,000 feet. The barographs and instruments will be sent to the Bureau of Standards at Washington, where they will be calibrated and the official altitude will be announced.

The aircraft was piloted by former Lieut. Commander David McCulloch of the Navy, who was pilot of the N C-3, which attempted the trans-Atlantic flight in 1919. With him were Grover C. Loening, inventor of the plane; L. R. Grumman and L. D'Orcy. The ascent was made in fifty minutes, and Mr. Loening said the machine easily could have climbed to 23,000 feet. He was forced to descend because of the discomfort caused by the changing temperature—75 degrees Fahrenheit at the ground to 28 degrees at the peak of the ascent.

The machine is the first hydro-monoplane to be developed in America for commercial work. It is of the pusher propellor type, and carries a 400 horse power Liberty motor. The cabin is about the size and shape of a sedan automobile body, and the motor is mounted above and behind this. Before the attempt to break the altitude record, the machine attained a speed of 130 miles an hour when flown near the ground.

The Aero Club in a statement was enthusiastic over the flight. It said the performance of the plane shows American-built machines are superior to foreign sea-planes of this type designed especially for sport and commercial purposes. The Contest Committee of the club was represented at the test by Caleb S. Bragg, Chairman, and Morris G. Cleary. Those who watched the flight included Congressman F. C. Hicks of the Committee on Naval Affairs; Commander Cabaniss of the U. S. S. Langley; Lieut. Commander J. A. Davis and Augustus Post, Secretary of the Aero Club.

Aerocruiser Corporation Test New Motor

The Aerocruiser Corporation of America, with offices in St. Louis and Washington, D. C., announce that they have just completed successful preliminary tests of their powerful new type of gas motor, the Tandem motor, at Detroit.

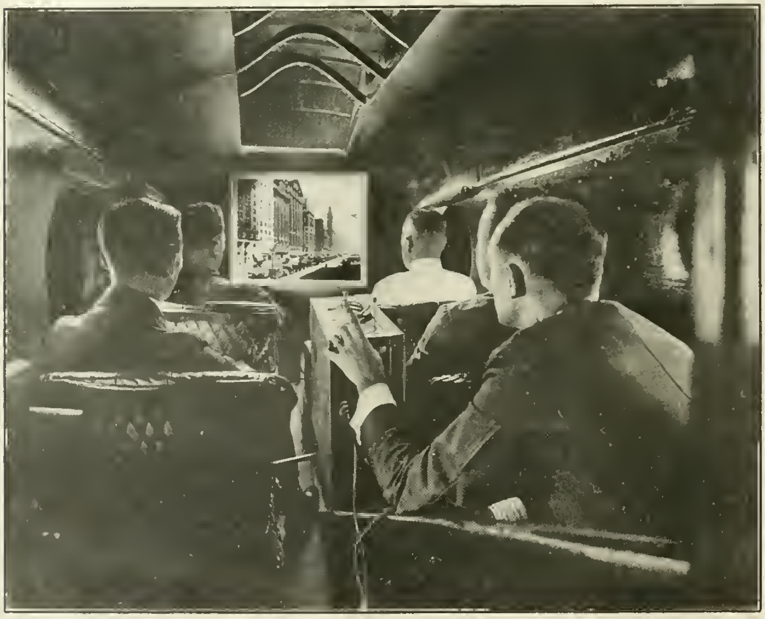
With this powerful specially designed motor the Company Engineers claim that they will be enabled to drive a 530 foot Aerocruiser, having gas capacity of 3,800,000 cubic feet (over one million feet greater than the ZR-2), through the air from New York to London or to San Francisco in 24 hours in non-stop flights.

The aerocruiser is a new type of rigid dirigible balloon, an American invention, having no resemblance in its formation and construction to the Zeppelin type or so-caeld "cigar-shaped" airships.

One of the 530 foot types of this airship powered by a battery of their specially designed Tandem motors should carry 200 to 250 people from New York to London through the air at better than 100 miles an hour. This claim made by the company engineers has been ratified by competent aeronautical experts, based on the power to be derived from the special engine.

The new type engine and the new type airship is the result of eighteen years of intensive endeavor to bring out a "best" in their types.

The Aerocruiser Corporation of America was organized in 1917 to take over the patents of the inventor, Thomas A. Finley. An eleven foot model of the Aerocruiser is now on exhibition at the Washington offices of the Company in the Union Trust Building.



Motion pictures on the screen while flying through the clouds at 90 miles an hour! History's first aerial movie show was on board the eleven-passenger hydroplane, Santa Maria, at the Chicago Pageant of Progress—and the first picture ever to be projected 2,000 feet above the earth's surface was "Howdy Chicago!" produced by the Rothacker Film Co. for the Chicago Boosters Club, for use in telling the world about the windy City's selling points. A screen was hung in the forecabin of the machine; a DeVry suit-case projection machine fastened firmly in position and connected with an electric light socket. The projectionist pressed the button and the audience beheld cinema views of Chicago while flying over Chicago. Before the flight it was feared that the vibration of the giant hydroplane as it shot through the air at 90 miles an hour would seriously interfere with the screening. But it did not. This historic flight demonstrated the practicability of movie entertainment for transatlantic aerial commuters in the days to come

Research University to Have Aeronautic Course

In cooperation with the three divisions of the Air Service of the United States Government, Research University at Washington, D. C., will start a course on September 19 in aeronautics. This will be one of the most thoroughly conducted schools for aviators in the country. Leading experts in the Army Air Service, the Navy Air Service, and the Air Mail Division of the United States Post Office will cooperate in planning and administering and teaching courses in the new school.

From the start Research University School of Aeronautics will meet all requirements of the Government and will obtain the use of aeroplanes and other means and methods of instruction.

Students are expected from all parts of the United States to attend these courses, and work will be arranged both by correspondence and residence instruction. For the benefit of those who are employed in Washington during the day, the courses will be held in the evening two or more days of the week from seven or eight to ten o'clock.

Research University is a cooperative institution of higher learning in the District of Columbia, run on a non-profit-making basis, largely for the education of federal employees of the District.

The School of Aeronautics is in the College of Commerce. Persons who are interested in the school either for resident or correspondence study should write to President Louis W. Rapeer, 20 Jackson Place, D. C.

Suggest Dirigible Circle Globe

A round-the-world voyage for the dirigible ZR-2 after it has been given a proper reception in this country upon its delivery here from England was proposed to the Navy Department August 16 by the World's Board of Aeronautical Commissioners, Inc., of which Charles J. Glidden is secretary. The commissioners are now represented in eighty-one countries, and promise to look after the technical needs of the big air voyage if the trip is made.

It is proposed to have the ZR-2 start westward across the continent, then over the Pacific via Honolulu, Yokohama and Shanghai, thence to Rome, Paris and London. The distance computed through these points is 22,847 miles, and could be accomplished in about seventeen days flying time as the commissioners figure it.

Omaha Enthusiastic Over Aero Meet

Gutzon Borglum, world famed sculptor, designer of "Stone Mountain, Georgia," "Lincoln," and other famous works in this country, will design a medal for the first *Internationol Aero Congress,* to be held in Omaha, November 3-5, 1921.

The medal will symbolize the work of the American airmen during the war and the future possibilities of aviation in this country. It will be cast in bronze and will be presented to distinguished visitors at the Congress to commemorate the event.

Mr. Borglum expects to have the medal finished soon acording to the latest word received from him by the heads of the Aero Club of Omaha, Inc., which is sponsoring the big Congress.

The entire city of Omaha joined in preparing the new Municipal field, to be used for the meet.

Thursday, August Eighteenth, was set as the day for clearing the field which was full of trees, hummocks and everything that would tend to wreck an ordinary aircraft.

The Holt Manufacturing Company furnished a twenty ton and a ten ton Holt caterpillar tractor which jerked the trees out by the roots with the greatest ease.

Former flyers, members of the Aero Club of Omaha, Inc., rolled up their shirt sleeves and helped remove the trees. They were assisted by American Legion men and businessmen of Omaha, who made short work of clearing the big 106 acre flying field.

Ladies of the Prettiest Mile Club furnished luncheon for the workers.

Profits, if any, from the first International Aero Congress are to be used to purchase the field which is to be donated to the city.

According to Major Ira A. Rader, head of the Seventh Army Corps Area, and other army officers, the field is the most favorable in the country for a Municipal landing field. It is absolutely flat with the Missouri River on one side and a railway on the other, offering facilities for flying boats as well as the advantage of loading planes on the field. It is only fifteen minutes ride from the heart of the city, adjoining paved streets and boulevards.

Defects Reported in ZR-2

LONDON.—Unless the dirigible ZR-2 sails for the United States during the next three of four weeks, she probably will have to wait until next year, because of weather conditions, according to *The London Observer,* which asserts that defects in the dirigible, which had been kept secret for four or five weeks, are no longer a secret.

During the first trials of the ZR-2, the newspaper says, a tendency of the great balloon to "hump" developed, and an inspection revealed that certain girders had bent and that lattice work had buckled under the strain. Remedial measures were taken, including considerable reinforcement of the framework along much of the airship's 695 feet of length. This involved additional weight, the newspaper states, and a slight increase in the load the dirigible can lift.

In addition to this structural trouble, The Observer asserts, the ZR-2 has been handicapped by engine difficulty, but it adds that the element of weather is the one which is causing the present delay in the final tests.

Shackleton Takes Plane

Sir Ernest Shackleton"s' ship, the Quest, has a special deck on which is housed a specially constructed aeroplane. This will be Sir Ernest's fourth journey to the Antarctic, and he contemplates that the aeroplane will be invaluable in reaching points inaccessible by boat.

MANUFACTURERS AIRCRAFT ASSOCIATION REQUEST CO-OPERATION

HAVING in mind that at the moment there is a Federal bureau whose function it is to register aircraft and pilots, the Manufacturers Aircraft Association has requested AERIAL AGE to give nation-wide publicity to a questionnaire which it has prepared. The Association wants this information to be in a position to supply statistics to the various governmental departments and civilian bodies endeavoring to frame definite plans and regulations as part of a national policy for aerial navigation.

Following is the questionnaire, which it is hoped everyone will fill out and mail promptly:

Report for Year October 1, 1920—*October* 1, 1921.
(Must be received not later than Oct. 7.)

1. Did you make report to Aircraft Year Book for 1921?....
2. Name of organization (if incorporated, say so and give capitalization and names of officers).......................
....
3. Location of mail office. Town...........State...........
4. Location of terminals:
   (a) Owned or leased..
   (b) Size ....
   (c) Number and size of hangars..........................
   (d) Shop and repair facilities.............................
5. Equipment—give number, name and type of all aircraft and engines operated. thus,—One Aeromarine Model 50-B.-2 flying boat, Wright engine; One Curtiss J.N.-4, C-6 engine, etc.
....
....
....
....
6. Approximately how many flights of all kinds have you made from Oct. 1, 1920, to Oct. 1, 1921?.................
7. What was average duration of flight?.....................
8. What is approximate total mileage for this period?........
9. How many passengers have you carried during this period? ....
10. How many pounds of package freight have you carried in this period? ....
....
11. What do you charge per passenger per short flight?.......
12. What is your charge per pound per mile for package freight? ....
13. Between what cities do you fly?
    (a) Regularly? ....
    (b) Occasionally? ....
14. What is your charge per passenger per mile for such intercity flights? ....
15. Accidents.

NOTE: Our purpose is not to make public accidents suffered by each company, to the consequent embarrassment of the company; it is to get as accurate an idea as possible of the number and cause of accidents and to draw helpful deductions. Your co-operation is earnestly requested. The name of your company will not figure in any connection with accident figures.

(a) How many accidents of all sorts have you had in the period of this report?..........
(b) How many fatalities?....................
(c) How many injuries?.......................
(d) List the more serious accidents and give their cause somewhat as follows:
....
....

1. Lack of public landing fields...........
2. Lack of air routes...........................
3. Lack of weather reports....................
4. For judgment by pilot........................
5. Fault of accessory (specify)..............
6. Fault of plane (specify)....................
7. Fault of engine (specify)...................
8. Fault of gasoline or oil (specify)........

Remarks ....
....
....

Please send us interesting photographs and copies of literature prepared and distributed by your organization.

Noteworthy details of your operations: ....
....
....
....

Mail to: Manufacturers Aircraft Association, Inc., 501 Fifth Avenue, New York City.

The AIRCRAFT TRADE REVIEW

Aerial Lines Carry 2,007 Passengers in Three Months

The first official report covering commercial flying operations to and from New York just forwarded to the Bureau of Aeronautics, Navy Department, by the Aeromarine Airways shows that the first three months of operations 2,007 passengers were carried 28,171 miles in the air by four flying boats without a single injury. These figures are exclusive of crews, each boat carrying a pilot and mechanic every flight.

The report covers the first quarter of the sight-seeing service around New York City, and services to and from nearby seashore resorts. The only mishap recorded in the report occurred Sunday, August 7th, when the flying boat "Ambassador" made a forced landing with six passengers in the violent storm while flying from Atlantic City to New York.

It points out that the landing was safely made alongside a yacht belonging to the president of the Company, and that the passengers, and crew were safely transferred, and the flying boat successfully towed back to the hangar. This forced landing occurred in a storm which was so violent that it actually tore up pavement in the city streets, and blew down garages, and resulted in serious accidents in other forms of transit in and about the city. The flying boat easily weathered this terrific storm and landed its passengers without injury. All four were impressed with the stability and safety of the flying boat in the terrific storm, and readily made the second flight.

Spraying Trees From an Aeroplane

The novel experiment of spraying a grove of trees from an aeroplane, the first ever attempted in the United States, was made on August 4th over the farm of Harry A. Carver, near Troy, Ohio, to prevent further ravages of worms which have twice practically defoliated this grove of 5000 Catalpa trees. The plane, piloted by Lieut. John A. Macready, Air Service, and carrying E. Dormoy, McCook Field, designer, who constructed the sifter used to spray the arsenate of lead powder, flew within 20 or 25 feet of the top of the trees, releasing the powder which was carried by the wind and air currents from the ship's propeller into every part of the grove. Treatment of trees in this manner saves much time and labor, as an aeroplane in a few minutes can do work which would require a number of men and many pump sprays several days. The effect of this experiment will be watched with interest by entomologists and forestry experts in many parts of the country, especially in the east, where a similar scourge is working havoc with many magnificent elm trees. The idea of utilizing an aeroplane for this purpose originated with Mr. C. R. Neillie, of Cleveland, who came to Troy to witness the first trial. Mr. H. A. Gossard, Chief of the State's Department of Entomology, also came to witness and assist in the experiment.

Mr. Dormoy is understood to be working on a new hopper which will simplify spraying of the powder, and McCook Field officials have indicated their willingness to cooperate with farmers and with the Department of Agriculture in combating insects and tree infection.

Achievement for Curtiss OX

Many have said an aeroplane is obsolete in six months and not suitable to fly one year after it has been built or in service. This may hold true for some cases but evidently does not hold true for this small machine.

During the week of July 11, 1921, this aeroplane, which is engined with a Curtiss OX5, flew from Los Angeles to Bishop, Calif., in four hours five minutes, a distance of 287 miles. The ship was piloted by Mr. Wally Timm with Mr. Leon Short as passenger. Gasoline sufficient to reach Lone Pine was carried and destination reached in three hours and twenty minutes. The altitude at Bishop is 4,000 feet and Lone Pine 4,300 feet. To reach either of these points it is necessary to cross desert and mountainous country. The return trip was made in three hours forty-five minutes. The only expense shown was for gasoline and oil. The story of Mr. Timm and Mr. Short regarding the trip speaks well for Mr. Timm's ability to handle the machine and select a beautiful and pleasant trip.

This is the first time a machine engined with a Curtiss OX5 has been able to make the trip, for several attempts have been made in other machines.

The history of this little machine only goes to show that it is not unreasonable to expect a great deal from a machine. The machine making this trip is over five years old.

The Aerial Mail Service

The Air Mail Service will soon place in operation six remodeled aeroplanes of the DH type on the transcontinental air mail route between New York and San Francisco. These planes are army planes and by changing the wing and body capacity they will carry double the amount of mail now carried in the Air Mail Service by this type of plane. Eight hundred pounds of mail or 32,000 letters will be carried on the remodeled plane with the same amount of fuel and the same man power, one pilot.

The first of these remodeled planes was inspected at Bolling Field, Washington, this morning by Postmaster General Hays and his assistants, Work, Shaughnessy and Glover, with other postal officials.

The cost of remodeling these planes is about $3 000 per plane whereas the cost of a new plane is about $15,000.

These planes will be compared on the most difficult part of the transcontinental route, which is over the Rockies, flying along with one of the planes now in use which carries only 400 pounds of mail. It is expected ultimately to use this type of remodeled plane on the entire route which will increase operating capacity 100 per cent.

The remodeled plane is the latest type of ship for mail carrying. The experience of the Post Office Department with a number of different types of plane has resulted in the conclusion that the best type of plane for use in the Air Mail Service is a single-motored plane carrying approximately 800 pounds of mail, or 32,000 letters, with a high speed of 115 miles per hour, landing speed of 50 miles per hour, and a cruising endurance of four hours.

The remodeled plane is en route from New York to San Francisco on its initial trip. It will be sent to the Minnesota State Fair held at the Twin Cities, September 3-10, together with Aeroplane No. 12, which made the initial trip May 15, 1918, when the first air mail route was established between Washington and New York. This old plane has been in service for a period of three years and five months. It is a Curtiss model JN4H with a 150-H.P. Hispano-Suiza motor. It has a carrying capacity of 200 pounds of mail or approximately 8,000 letters, with a cruising endurance of three and one-half hours. Its speed is 75 miles per hour. The records show that this plane has flown over 40,000 miles.

During July of this year the Air Mail Service flew 13,150 miles with mail, carrying 224,000 letters, with a percentage of performance of 100% New York to Chicago; 99% Chicago to Rock Springs, Wyo., and 98% Rock Springs to San Francisco. The mileage for the transcontinental route is 2,630 miles from New York to San Francisco.

During the year ended June 30, 1921, 1,770,658 miles were flown and 44,834,080 pieces of mail were carried, with a percentage of performances for the year of 85.96 per cent. There are 49 pilots, 380 mechanics and 86 planes used on the transcontinental route. There are air stations at New York, N. Y., Bellefonte, Pa., Cleveland, O., Bryan, O., Chicago, Ill., Iowa City, Ia., Omaha, Neb., North Platte, Neb., Cheyenne, Wyo., Rock Springs Wyo., Salt Lake, Utah, Elko, Nev., Reno, Nev., and San Francisco, Cal. The Post Office Department is now negotiating at other points for Joint Army and Post Office fields.

C. F. Egge, Superintendent of the Air Mail Service, is in San Francisco to arrange for using Crissy Field of the Army at that place.

Air Service Orders

Following to Ellington Field: Major Coleman, F. H.; Capts. Broberg O. W.; Elmendorf, H. M.; Guidera, A. M.; Holmberg, J. B.; Skeel, B. E.; 1st Lts. Ladd, A. K. ;McBride, B. R.; Summers, J. D.; Wilson, J. H.

Howard, Capt. D. B., to Balloon School, Ross Field.

Giles, Capt. B. F., to Carlstrom Field.

Shangraw, 1st Lt. C. C., to Arcadia, Florida.

Rouse, 1st Lt. H. F., to Comdg. Officer, Langley Field.

Hodge, 1st Lt. G. E., to Chief of Air Service.

Lynch, 1st Lt. J. E., to Washington, D. C.

Carpenter, 1st Lt. E. J., to Bolling Field.

THE DISTANT COMPASS

By WALTER FRIEDENSBURG*

FOR a long time, small fluid compasses were almost exclusively used on aircraft. Such a compass consists essentially of a number of comparatively weak magnets which, supported by a hollow float, turn on a needle point in a vessel filled with alcohol and water. This would answer for ordinary use, if there were on the aircraft no iron parts and no other magnets, like starters, magnetos, dynamos, etc.

The compensation of these disturbances by small magnets is only a makeshift and by no means frees the compass readings from error. The many neighboring movable iron parts, like steering devices, weapons, tools, bombs, etc., even key-rings, knives and the like in the pockets of the occupants, exert, according to their size and proximity, a varying influence on the compass readings which, on the aircraft, are hardly controllable and cannot be corrected, any more than the constantly varying influence of the above mentioned magnets.

Every deviation of the aircraft from the horizontal position, in either a lateral or longitudinal direction, likewise exerts an influence on the compass readings. Thus there are generated, especially by sudden changes of position in curved flight, oscillations of the card which may even increase to the complete revolutions dreaded by every aviator.

The oscillations of the compass card, due to those magnetic and mechanical influences, are indeed deadened by the compass liquid, but this friction is operative not only in the indicated instances, when the card, with the magnets, oscillates with reference to the compass vessel, but also when the system is at rest and only the vessel turns, as in every curving flight. In the latter case, the card is also carried along and indeed just so much more, the weaker the magnet system and, accordingly, its directive power. On the other hand, the greater the directive power of a magnet system, the greater are its errors of deflection from neighboring masses of iron. These errors call for stronger compensation magnets which, the stronger they are, the more they weaken the directive power of the system. Out of this endless circle there was yet on an aircraft only the unsatisfactory compromise. The employment of a reliable magnetic compass, free from objections, was impossible and one was compelled to make the best of inaccurate and unsatisfactory compasses.

An improvement of the properties of the aeroplane compass to real serviceableness in aerial navigation is only possible then, when the disturbing causes are eliminated. The Navy prescribes for every compass on shipboard a minimum distance within which there must be no iron. This is impossible on an aeroplane, since there is no such amount of room free from iron from within view of the pilot or observer. It is difficult to install a compass on an aeroplane at all, on account of the limited space.

On the other hand, the remedy by placing the compasses in magnetically somewhat more favorable position, for instance, on the upper or lower supporting deck, presents many other disadvantages: inconvenient reading of the compass, difficult and inaccurate steering by such a distant instrument, compulsory cessation of the possibility of taking bearings, as also the impossibility of using adjustable indicators and other accessories, mistakes in reading oblique and side views, insufficient protection of compass against cold and wet, as also against the force of the air current which, in such a location, often tilts the compass or even upsets it. Moreover, only small compasses with weak magnets can be used, since a higher directive power cannot be employed, for reasons already given, and the still unavoidable proximity of iron and because the limited space prevents the installation of larger compasses.

Against the use of the ordinary compass on an aeroplane there are various further practical considerations. Steering by a reference mark and the general use and complete utilization of such a compass requires too much experience on the part of the pilot, especially of one with little or no knowledge of navigation, while even an experienced and educated pilot finds it too strenuous to watch the card, with its finely divided scale, and, at the same time, attend to the numerous details of managing the aeroplane, observing, fighting and keeping constant watch of the ever-increasing number of instruments. The increasing demands on the pilot emphasize the need of direct communication between him and his observer, in order to do away with time-robbing attempts at speech, signals and makeshifts.

For solving all these problems, there is now a new device, the "distant-compass" constructed by Carl Bamberg, Friedenau, and improved in 1918 by the Seaplane Division and practically tested in comprehensive experiments and use at the front. Since this compass does not need to be in sight of the aviators and can be located far from all iron parts, it can be as powerful as those used on ships. This compass is free from error down to the fraction of a degree and at least as reliable as those on large ships. The most favorable location on the ordinary type of aeroplane is from one to one and a half meters behind the rear seat in the fuselage, where the compass, enclosed in a wooden case (see Fig 1), is protected from the wind and weather. The magnet system is the same as demonstrated its stability in the submarines. Its use on aeroplanes has greatly increased the accuracy of steering in comparison with the compasses formerly used, and,

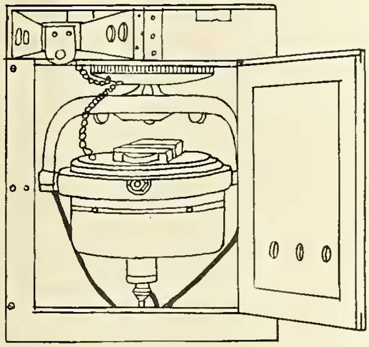


Fig. 1.

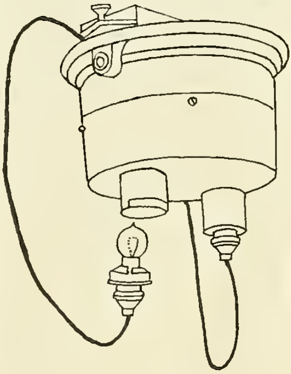


Fig. 2.

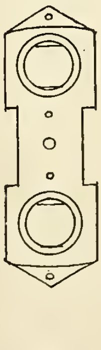


Fig. 3.

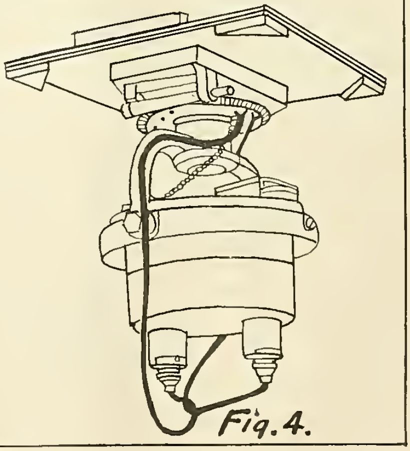


Fig. 4.

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* From "Zeitschrift für Flugtechnik und Motorluftschiffahrt," August 15, 1920.

even while flying in clouds and bad weather, there were no harmful oscillations nor revolutions. Not much compensation is usually necessary, since in every type of machine it is possible to find a location entirely free from magnetic disturbances. The improvement thus obtained consists first in eliminating the compensation, which always requires an expert, and further, in the fact that the directive power of the compass is not weakened by compensation magnets.

The magnet system of this compass is supported in the usual manner in a compass-vessel filled with alcohol and water. In the bottom of the vessel there are two lighting devices (each consisting of a small electric bulb and "condenser"), which throw two cones of light, sharply defined by the condensers, up through the compass liquid (Fig. 2). Both light-cones fall on two selenium cells (Fig. 3) which are applied in an air- and water-tight cap to the vessel (Fig. 4). The electric resistance of the selenium is lessened by the illumination, so that, for instance, an electric current passing through it can cause the pointer of an indicator to move. For the distant-compass, a special precision galvanometer with suitable scale serves as course-indicator (Kurszeiger), with radiumized marks and pointer. (Fig. 5).

The magnet system carries a diaphragm which, in a certain position, simultaneously intercepts both light-cones and leaves both selenium cells dark. If now the compass vessel (Kompasskessel) is rotated about its vertical axis, whereby the magnet system remains constantly in the north-south direction, one or the other cell passes out of the diaphyagm shadow into one of the light-cones and the pointer moves to one side or the other. In this way, every swing of the compass vessel can be read on the course-indicator and, indeed, so that the amplitude of the oscillation of the pointer is proportional to the deviation from the course. This result is obtained by giving the proper oblique shape to the diaphragm, so as to cause a gradual strengthening or weakening of the illumination and therewith a proportional decrease or increase of electrical resistance in the selenium cells. This method of transmitting the compass indications differs from most other known methods in that it is accomplished without influencing the compass card of weakening its directive power.

Any seaplane or aeroplane provided with this device can be steered exactly in the desired direction, since every deviaation from this direction causes a rotation of the compass vessel with reference to the magnet system, which is immediately indicated. The pilot only needs to turn the rudder right or left according to whether the pointer moves to the left or right. This device has two fundamental advantages over the ordinary compass. First, the pointer moves a relatively longer distance than the card of an ordinary compass, a deviation of 15° from the course, causing t motion of about 5 cm. in the former case to anly 1 cm. in the latter case, making the accuracy of the reading about five times as great for the former. Second, this compass, like all the other instruments on the aeroplane, is read on a fixed scale by means of a mobile pointer and thus spares the aviator the special thought required, on all other instruments, for reading the mobile card scale with reference to a fixed steering mark.

If the compass vessel is rotated a certain angle, say 65°, with reference to the longitudinal axis of the aeroplane, then the new course, if flown according to the course-indicator, will evidently deviate 65° from the original direction, since one of the selenium cells receives the light and thereby brings the course-indicator to one side, until, by the turning of the aeroplane itself 65°, it comes again into the shade of the diaphragm. At any time during flight, any desired new course can be established by turning the compass vessel the desired angle with reference to the longitudinal axis of the aeroplane. The compass vessel had for this purpose a suspension device which can be readily rotated by means of a worm gear (Fig. 4).

For this purpose, the compass is placed in the rear part of the fuselage or other iron-free location. The turning of the compass vessel, and with it the establishment of the course, is then effected by means of a flexible shaft (Fig. 7) which is within reach of the aviators and is turned by a crank. By this shaft a compass card near the crank is simultaneously turned exactly the same angle as the compass vessel, so that on this course-giver (Kursgeber) (Fig. 8), the angle and thus the compass course can be read. Naturally, in such a system with a flexible shaft, several course-givers and course-indicators can be installed, for the pilot and observer and any other persons in any part of the aeroplane, who are thus enabled to observe and assist in the navigating.

The heat generated by the electric lamps prevents the freezing of the compass liquid, even in very cold weather. The minimum current required for the compass installation is about 10 watts. This current can be obtained by connecting the system with a source of electric current already on the aeroplane, but is usually supplied by a small airscrew double generator of especial reliability (Fig. 9), specially constructed for this purpose, with an output of 40 volts, 6 milliamperes for the indicator circuit, which flows through the selenium cells, and 8 volts, 2 amperes for the electric lamps, and weighs only 1.8 kg. (4 lbs.). The tension of the generator is kept constant between 3700 and 7500 r.p.m. by an automatic regulator according to the Sumner principle. The best location for the generator is in the air current from the propeller. The number of r.p.m. required for the work of the compass system was found in a test to be about half the r.p.m. of the engine.

The weight of a complete distant-compass set, with two course-givers, course-indicators, generators, cables, shaft, etc., was about 9 kgs. (20 lbs.).

Practical Application of the Distant-Compass

The course to be steered (for example, 130°) is set by the pilot or observer, while the crank of one of the course-givers is turned so that this degree number of the compass card comes opposite the steering mark of the course-giver. Thereby the whole system is adjusted to the 130° course and the pointer of the course-indicator oscillates until the aeroplane is brought exactly on this course. If, for instance, the previous course was 45° N.E., then, after setting it at 130°, the pointer lies hard to the left. The pilot then turns the rudder continuously to the right, in order to bring the pointer to the middle. When the aeroplane, in turning to the right, reaches course 100°, then the pointer, with the further turning of the aeroplane, beginning to move slowly, lies at 130°, it stands on the middle point. If the aeroplane turns too far, say to 135°, then the course-indicator moves cor-

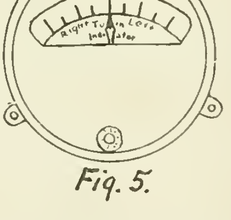

Fig. 5.

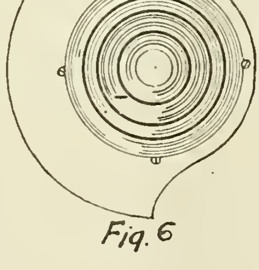

Fig. 6

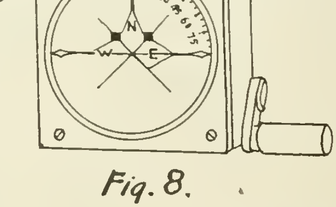

Fig. 8.

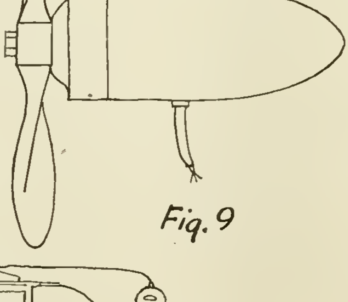

Fig. 9

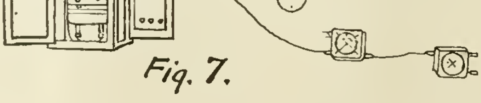

Fig. 7.

respondingly to the right until, by steering to the left, the aeroplane is brought back to the course and the pointer to its middle position. Further holding to the course is accomplished in the same manner, since, on the slightest deviation of the aeroplane from its course, the pointer moves to the corresponding side and indeed proportionally to the deviation, so that the aviator is always given the measure for the degree of correction in steering. Up to 30° on either side, the motion of the pointer is proportional to the deviation from the course. Above 30° the pointer remains in the same position. This angle of 30° has been found suitable in practice for an ordinary aeroplane, but it can be varied at will, according to the size and corresponding sensitiveness of the aeroplane (or airship), by resistance, from 5° to 40°.

Every change of course during flight is accomplished in the manner indicated by setting one of the course-givers for the new course and steering according to the course-indicators, without the necessity of any communication between the occupants by signs, notes, etc. Also the observer or any other occupant can, without any closer understanding, call the attention of the pilot to an object that the latter has not noticed, or accurately indicate a target, since the pilot has only to steer according to the pointer, the accuracy of which makes it possible to steer for the smallest goal.

If it should happen, in curved flight or great changes of the course, that the course set on the course-indicator should be exactly opposite to that followed by the aeroplane at the time (for example, set on the course-giver: East 90°, aeroplane flying west = 270°), the course-indicator in this special case, when the difference is just 180°, stands in its middle position, which results from the two selenium cells being located at 180° apart. This position, however, hides no possibility of error, because it is immediately evident that (likewise following from the construction) the course-indicator swings in the opposite direction than when the aeroplane is flying on the course set. If the aeroplane, as assumed in the example, is flying west and turns only one degree to the right of this course, the pointer swings to the left and the pilot must therefore steer to the right. Thereby he continually goes further to the right from his false west course, for the pointer remains on the left until the aeroplane is again on the east course for which the course-giver is set. Only then is the pointer again in its correct middle position. The second and opposite middle position of the course-indicator makes it possible therefore for an aeroplane that has deviated by a large angle, (around 180°) from its correct course, to be always shown the smaller angle and therefore the shorter way back to its correct course. Every aviator must therefore become accustomed to following the course-indicator blindly, then, whether in clouds or fog, even in battle, after completely losing his bearings, he will immediately return to his correct course, without danger of the compass whirling, even from the most violent motions of the aeroplane.

The sensitiveness of the pointer, which indicates deviations of fractions of a degree from the direct course, enables the aviator to fly straight ahead and horizontally in clouds and at night. Only this condition enables the use of aeroplanes for photogrammetric surveying which requires the holding of a straight line and further imparts genuine accuracy to observations from an aeroplane and from the earth, which unconditionally require straight lines, like speed measurements, etc. True, there already exists in the Drexler Gyroscope Indicator (Kreiselssueranzeiger) a highly sensitive instrument for facilitating direct flight, but its value is confined exclusively to the aerodynamic field, since it only shows whether, for the time being, the aeroplane is flying straight ahead or in a curve, and does not enable the holding of a single definite course, like the distant-compass course-indicator.

Furthermore, the distant-compass not only makes possible the general control of one's bearings, but also the accurate determination of compass, directions and variations, even without seeing the compass itself, because the card of the course-giver, as long as the aeroplane continues on the course set for it, always corresponds to the true magnetic compass card since the course-givers are always mounted parallel to the longitudinal axis of the aeroplane. A variation device attached to a course-giver is more convenient and utilizable for compass variations than when attached to the sensitive and mobile compass itself.

The advantages and possible applications of the distant-compass are so numerous that it has become one of the most important instruments for aircraft. This was also demonstrated by its adoption in 1918 for all former naval seaplanes, with the exception of combat aeroplanes, as well as for certain types of army aeroplanes. This device is a very important aid for commercial, as well as military aviation. By its advantages it increases both the safety and economy of aviation. The accuracy of course-steering, which the distant-compass has made many times greater than that hitherto attainable, lessens fuel consumption, facilitates unconditional reaching of one's goal even under the most trying circumstances, and diminishes the intellectual and nervous tension of the pilot, which is of especial importance in long distance commercial aviation.

It is not the purpose of this article to discuss the application of this invention to sea ships. The parallels are readily drawn. Even the farthest evolution possibilities open up favorable vistas. Thus, on a ship, there has been successfully substituted for the indicating instrument a relay enabling the compass to operate the rudder directly. Such a device, which has already been finished and tested, demonstrates the possibility of dispensing with the pilot and replacing him by an automatic and considerably more accurate steering-compass. The lateral steering of an unmanned aeroplane rests on the same principle.—*Translated for the National Advisory Committee for Aeronautics by D. M. Miner.*

KODAKING FROM AN AEROPLANE

By SEYMOUR WEMYSS SMITH

To the majority of pilots and practically all aeroplane passengers the possibilities of taking photos from the air are regarded as extremely remote, as the impression is widespread that for taking aerial views a special camera and lens equipment is needed. Of course, many pilots have taken snap shots with hand cameras, but usually these turn out to be entirely inferior photos, in which the landscape is more or less of a blur. However, it is possible to secure excellent aerial pictures without going to the expense or trouble of using a specially constructed camera. There are a few rules to be remembered, and simple ones at that, and once mastered, aerial photography is an open book.

The writer took three of the photos reproduced herewith while a passenger in one of the aeromarine R. S. naval model seaplanes on a flight from Hartford (Conn.) to New York City, a distance of nearly 200 miles by the water route, via the Connecticut River and Long Island Sound. Before leaving five extra film packs were secured. And then with our tiny camera (a Premo No. 12 model, with a Zeiss 6:3 lens and a compound shutter working up to 1/300 second) slung across our shoulder, we clambered into the plane and were ready for the trip.

In order to be certain that some worth while photos would be secured the writer "shot" sixty films between Hartford and New York, and fully fifty of these turned out to have been more or less successful. The films used in the Premo No. 12 are only 2¼ by 3¼ in size, the familiar Brownie size. However, the high speed shutter and the excellent lens provide a negative which will easily enlarge up to 8 by 10, or even to a larger size, without losing the detail of the original. There are many hand cameras which could duplicate the work produced herewith. Any of them are capable of good work, provided the shutter and lens permit.

In many ways the small cameras are ideal for aerial photography. They are light, the films are inexpensive and the speed of operation often compensates for the reduced size of the film. For instance, at least twelve of the 2¼ by 3¼ films can be exposed in the same time which would be required for half as many of the larger sizes. And when flying, speed of operation is an essential. One moment the ideal view is here, a moment later it is gone.

Many of the larger cameras are not as well suited to aerial work as the smaller sizes. For instance, the Graflex, splendid all around camera that it is, does not prove satisfactory in the air. The hooded focusing device, or the reflex feature, is practically useless and the quickly adjustable lens is apt to get jarred out of focus in the air. If a Graflex is used, it is advisable to find what is the "infinity," or maximum distance mark for the lens, and then lock it in place, so that the focus does not wobble out of range when flying. The focal plane shutter of the Graflex is, of course, an advantage. However, there are few occasions on which the 1/300 of a second of the fastest small camera shutters does not prove entirely adequate.

Aerial birdseye of the center of Hartford, taken at altitude of 400 feet while flying over East Hartford meadows. This view of the city would be impossible without the aeroplane, which allows one to maneuver into the position for the most artistic view

With the camera pointed directly downward, giving a map effect, extreme speed is not necessary and 1/100 of a second will often give a sharp negative, and the writer has known of some fliers who had reasonable success with small box cameras. However, the various small speed cameras, with high grade lens and shutters, give the most desirable results.

In enlarging from the small negatives remember that by stopping down the lens of the enlarging camera a much stronger result is secured. For instance, by stopping the enlarging lens to F 16 or even F 22 an immeasurably better result is obtained than with the lens "wide open." And give sufficient time to enlarging. A long exposure on slow developing paper gives the best result. If the flier don't do his own work let him ask that care be used in this respect, to preserve the full detail. Ordinary tank development will usually give good results with the negatives.

So far as a finder is concerned, successful results can be secured by merely pointing the camera in the direction of the object to be photographed. However, the direct view finders, attached to the side or top of the camera and giving a direct view of the object, are a decided asset in aerial work.

For photography from an aeroplane with a hand camera, the writer would suggest that 500 to 800 feet is about the most desirable altitude, while the shutter can be set at 1/300 of a second and the lens at F 6:3, taking all photos at the same speed. Variety may be the spice of life, but in aerial photography, unless the flier is experienced, it would seem better to set the shutter and lens for a fixed speed before the flight begins.

The North business section of Hartford, a few hundred yards away from the view in No. 1. Both of these photos were enlarged from 2¼ by 3¼ film. Lens was used at stop f.8 and speed of shutter was 1/300 second

The illumination on a bright day is tremendous and sometimes it may be desirable to stop the lens down to F 8. However, a hand camera and a little patience, and the would-be aerial photographer will discover that he can easily obtain highly satisfactory aerial photos. Even the occasional passenger will find he is well repaid in results for taking a camera aloft.

Map of Saybrook Point, where the Connecticut River merges with Long Island Sound. Altitude probably about 1,500 feet. Lens used at f.8 opening, shutter speed 1/100 second

View of the Connecticut River bridge at Hartford, with the plane of the Fokker from which it was taken visible at the top (note wooden construction of wing). Plane was banking at the time. Observe autos and cars crossing bridge and craft in river

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The Gallaudet Engine Gear

Providence.—A power unit for large aeroplanes consisting of three Liberty engines geared to a propeller with a clutch, claimed by its designer and builder, Edson F. Gallaudet, to assure nonstop flights from New York to Liverpool in twenty hours or less, and also to be one of the most formidable of military machines, was given an official test August 22 by Lieutenant R. Christensen, engineer on the NC-1 on its transatlantic flight.

The arrangement has been under construction for six years, and the completed product will soon be delivered to the Navy Department, as will two others which are now in the course of construction at the plant of the Gallaudet Aircraft Corporation at East Greenwich.

It is claimed that Mr. Gallaudet is the first to gear three Liberty engines to a propeller with a clutch. Two Liberty motors are side by side, with one in back, it being the plan of operation to run two engines with one always in reserve. In the test three 400-horsepower engines were geared to an eighteen-foot propeller, the arrangement being installed on a high platform.

General Squier's Work in Paris

American backing of wireless telephony as the big thing of the near future was the feature of the international wireless conference which closed August 22 after having been in session for two months. The American delegation, headed by Major General George O. Squier, chief of the Signal Corps of the United States army, came to Paris with a definite program. Most of this program is said to have been adopted, although the conclusions of the conference will be kept secret until they are presented to the various governments by their delegates.

The Americans pictured Presidents and Premiers of the future speaking directly among nations and emphasized the overwhelming importance of wireless telephony in supreme moments, as well as the necessity for aiding in its development.

The activity of the Americans in "selectivity," or the development of the equivalent of the private line wireless, as opposed to the present "party line," where anyone may listen in on a conversation, met with recognition by the conference.

Among the fourteen principal questions with which the conference dealt and adopted was a recommendation by the Americans that certain waves be assigned in each country, with treaty provisions limiting each country to the use of instruments adapted to those wave lengths so that the result would be secret wireless.

EXPERIMENTAL REINFORCED PLYWOOD TRUSS RIBS

By B. C. BOULTON, Aeronautical Engineer, McCook Field

(*Concluded from page* 541)

The next development was the design of a series of ribs with a chord length of 15 feet. As it was desired to determine the value of reinforced plywood truss ribs for both deep and shallow wing sections, one set of ribs was designed with the USA-27 section and one with the USA-5 section. Each of these has a high lift coefficient and is suited for a heavy wing loading. In Table V are the data upon which the original design for the first set of ribs was based.

TABLE V

Chord, 15 ft., or 180 in.
Wing section, USA-27.
Front spar at 13 per cent of the chord from the leading edge.
Rear spar at 65 per cent of the chord from the leading edge.
Wing loading, 11¼ lbs./sq. ft.
Load factor, 4.
Rib spacing, 21 in.
Required ultimate strength for rib, 1,200 lbs.
Triangular loading with apex one-third way back.
Triangular loading with apex at leading edge.
Test loads spaced 6 ins. apart.
Subdivided Warren truss with diagonals adjacent to spars in compression used for web system.
Compressive strength of wood, 5,500 lbs./sq. in., based on net section[1] reduced for column action by formulas $C=5{,}500-0.48/c\ (L/p)^2$ for short columns and $C=c\times 1{,}580\,000\ (L/p)^2$ for long columns.
Modulus of rupture, 8,500 lbs./sq. in based on net section.
The allowable stress for the chord members in combined bending and compression was calculated by the formula,

$$F_a=\frac{f_b}{f_b+f_c}(8{,}500-C)+C.$$

Fixity coefficient for chord members=3.
Fixity coefficient for diagonal members=3 in plane of the truss and 2 in a plane normal to this plane.
The lengths of all web members were taken as the distances between the intersections of the center lines of the chord and web members.

The plywood employed in the construction of all the 15-foot truss ribs was $\frac{3}{16}$-inch spruce poplar plywood with the spruce face plies horizontal. All plies were of equal thickness. All reinforcing and cap strips were spruce of ¼-inch thickness and varying width.

A determination was made of the direct stresses for the loading given in Table V, considering the rib a pin-jointed truss. It was assumed that in actual test the loads would be all applied to the lower chord and spaced at 6 inches. The amount of each load was computed by plotting the position of the loads on the triangular loading diagram and calculating the area of the diagram for a distance of 3 inches on each side of each load. If the total area of the triangle represented the total load desired, the small areas represented the concentrated loads. The panel loads for the truss were computed by assuming that the sections of the chord between panel points were simple beams and distributing the concentrated loads accordingly. A diagonal was assumed in place of each spar, and one-half of each spar reaction was assumed to be applied to the member or members on each side of the spars. The stress diagram for this rib is shown in figure 11 and the key diagram in figure 12. A stress diagram was also made for the members between the leading edge and the front spar, using the loading for high incidence with the apex of the triangle at the leading edge. The bending moments produced by the concentrated loads on the lower chord are given in figure 13. They were calculated by assuming the chord a straight beam continuous between spars. To provide for the contingency of having the wing covering on the upper surface of the wing sewed to the upper chord, the bending moments, produced by a uniformly varying load whose intensity at any point equals 70 per cent that of the loading diagram, were computed assuming the upper chord a straight beam continuous between spars.

In the actual tests there were certain deviations from the conditions assumed. The loading was triangular with the apex of the triangle 25 per cent back from the leading edge. The concentrated loads, all applied on the lower chord, were spaced 3 inches apart. A summary of the test data on all the 15-foot plywood truss ribs is given in Table VII. Complete data on these tests may be found in McCook Field Report Serial No. 1425.

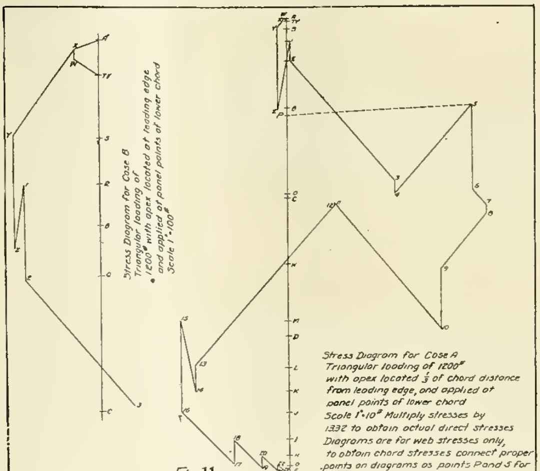
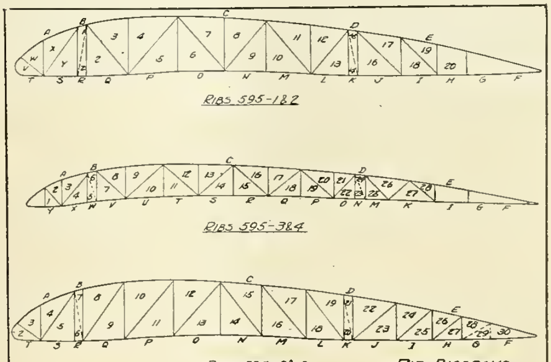
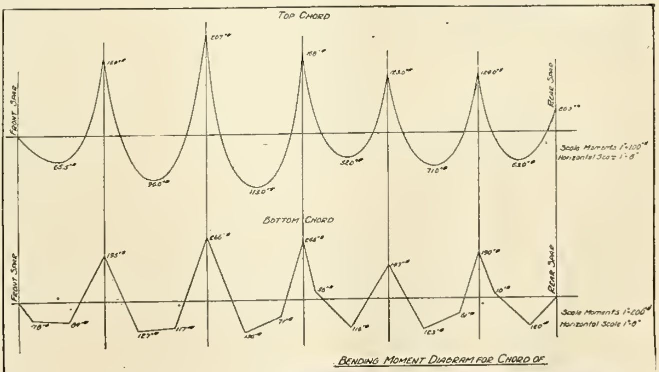

Stress Diagram for Case B
Triangular loading of 1200# with apex located at leading edge and applied at panel points of lower chord
Scale 1"=100#
Stress Diagram for Case A
Triangular loading of 1200# with apex located ⅓ of chord distance from leading edge, and applied at panel points of lower chord
Scale 1"=10# Multiply stresses by 1332 to obtain actual direct stresses
Diagrams are for web stresses only, to obtain chord stresses connect proper points on diagrams as points P and 5 for stress in P-5 shown dotted

Fig. 11.



RIB DIAGRAMS
Fig. 12.

The design of the ribs with the USA-5 wing section followed closely the methods described above. This design also employed the subdivided Warren truss type of construction with the heaviest stressed diagonals in compression. The only change in the data was the use of a loading with the apex of the loading triangle 25 per cent back, to correspond with the conditions of test. The stress diagram was prepared in the same manner as the one shown in figure 11. The stresses are



BENDING MOMENT DIAGRAM FOR CHORD OF REINFORCED PLYWOOD TRUSS RIB FOR USA-27 WING SECTION
Fig. 13.

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[1] In computing the net section, the effective area of the plywood in the chords and diagonals was assumed to be two-thirds its gross area.

listed in Table VI. In figure 14 are given the bending moments in the upper and lower chords between spars.

The revised ribs of the USA-27 section were designed with a Pratt truss web system in which all diagonals were tension members[1] and all verticals, compression members. The truss stresses were determined graphically as in the previous designs. A complete analysis was made for the test loading with the apex of the loading triangle 25 per cent back, and, as in the other cases, an analysis was made with the apex at the leading edge to determine the members in the nose section. The bending moments in the chords were assumed to be the same as those given in figure 13. The fixity coefficient in the plane of the truss for the web members was reduced from 3 to 2. In a plane normal to that of the truss this coefficient was unchanged. The effectiveness of the plywood in resisting stress when the direction of the grain of the plies was at 45° to the direction of stress was more accurately allowed for than in the first two designs. In figure 15 are given curves obtained from five sets of tests on plywood, in each of which the line of action of the load made different angles with the direction of the grain. No data were available for spruce-poplar plywood, so that strengths with the load applied parallel and perpendicular to the grain were computed, assuming an ultimate tensile strength of 12,000 lbs./sq. in. parallel to the grain and 600 lbs./sq. in. perpendicular to the grain. In compression the corresponding values were taken as 6,000 lbs./sq. in. and 600 lbs./sq. in. A curve similar to the one for 1/28 birch and 1/16 poplar plywood was then drawn through these two points. For the diagonal web members the value of the unit tensile or compressive strength at 45° was found. The ratio of this value to the tensile or compressive strength of spruce was taken as the measure of the effective area or moment of inertia. Corrected values for these properties were then combined with the corresponding properties of the reinforcing strips in computing the strength of the members. Figure 10 is a drawing of this rib.

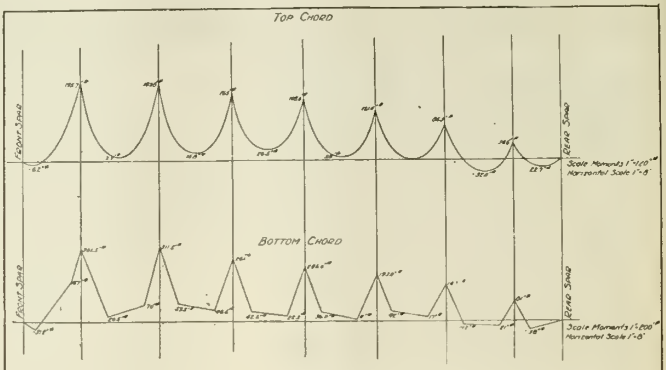
Before testing 595-6, members 9-10 and 11-12 were reinforced in plane perpendicular to rib.

The apparatus used in these tests is shown in figure 17.

All of the ribs can be reduced in weight about 4 ounces by cutting down the size of certain members. This reduction will be partly offset by the necessity for increasing the size of a few members. The resultant decrease in weight may be taken as 2.5 ounces. The original and revised weights are both given in Table VIII and the strength:weight ratios in this table are based on the maximum load sustained by each rib, and its revised weight.

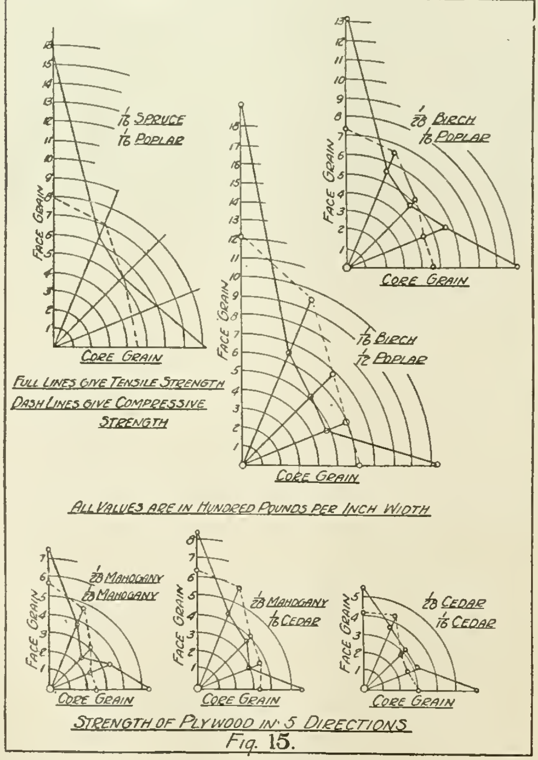
The strength:weight ratios given in Table VIII do not represent the best that can be done with this type of construction in 15-foot ribs. In the design of these ribs no information was available relative to the modulus of rupture of the T sections of the chords or the coefficients of fixity for the web members. Due to the assumptions which were made, the chord members were too large and the web members too small. In Table IX are given data relative to strength properties of sections of the chord cut from three ribs. The results, though consistent, are extremely high. It is not advisable to use a value for the modulus of rupture greater than 10,300 lbs./sq. in. based on the net section, this being the value for spruce.

A study of the failures of the web members gives information relative to the proper fixity coefficients. In Table X are given the computed coefficients for the web members which failed in test. In several cases coefficients both in the plane



Bending Moment Diagram for Chord of Reinforced Plywood Truss Rib for U.S.A.-5 Wing Section

Fig. 14.

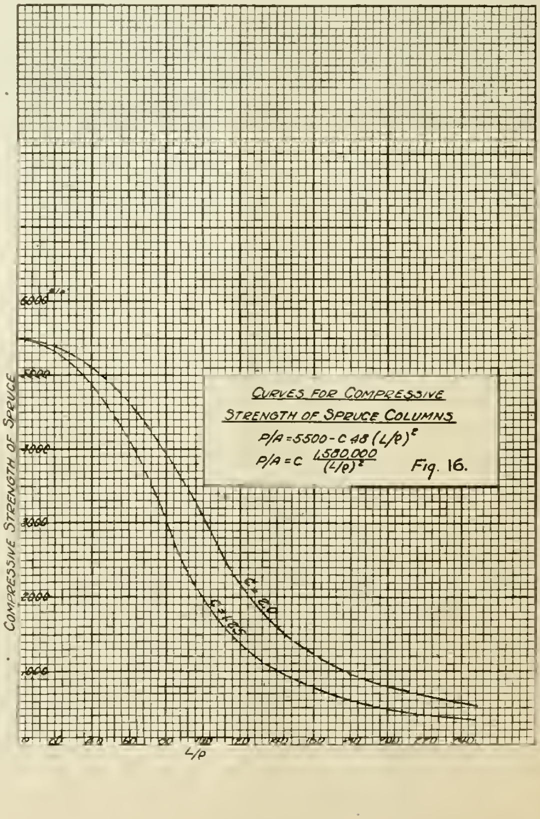


Full lines give tensile strength
Dash lines give compressive strength

All values are in hundred pounds per inch width

Strength of Plywood in 5 Directions

Fig. 15.



Curves for Compressive Strength of Spruce Columns

$P/A = 5500 - C\,48\,(L/\rho)^2$

$P/A = C\,\frac{1{,}580{,}000}{(L/\rho)^2}$

Fig. 16.

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[1] All tension members were limited by the compression occurring with reversed loading assumed equal to .40 per cent of the tensile stress.

TABLE VI

Direct Stresses in Rib Trusses for Load of 1,200 Pounds

Ribs.			Ribs.			Ribs.	
595-1 and 2.			595-3 and 4.			595-5 and 6.	
Chord member.	Stresses.		Chord member.	Stresses.		Chord member.	Stresses, loading 1.
	Loading 1.	Loading 2.		Loadin 1.	Loading 2.		
A-W	— 11	— 62	A- 3	— 10	— 92	A- 3	— 7
A-X	— 12	53	B- 6	— 7	—255	A- 4	— 7
B-Z	— 25	—178	C- 8	374	95	C- 8	7
C- 3	286	....	C- 9	371	....	C-10	276
C- 4	284	....	C-12	890	....	C-12	475
C- 7	523	....	C-13	890	....	C-15	382
C- 8	528	....	C-16	752	....	C-17	95
C-11	125	....	C-17	753	....	C-19	—296
C-12	127	....	C-20	10	....	E-22	—325
D-15	—291	....	C-21	10	....	E-24	—184
E-17	—149	....	D-24	—465	....	E-26	—110
E-19	— 75	....	E-26	—322	....	E-28	— 70
E-21	— 33	....	E-28	—154	....	E-30	— 50
E-23	— 10	....	E-30	— 66	....	F-30	50
E-14	— 10	....	E-32	— 20	....	F-29	50
F-24	9	....	F-33	0	....	G-27	70
G-22	36	....	G-31	45	....	H-25	110
H-20	73	....	I-29	115	....	I-23	180
I-18	148	....	K-27	242	....	K-18	— 92
J-16	287	....	M-25	462	....	L-16	—382
K-14	248	....	N-23	402	....	M-14	—510
L-13	248	....	O-22	402	....	N-13	—505
M-10	—405	....	P-19	—456	....	O-11	—475
N- 9	—402	....	Q-18	—455	....	P- 9	—270
O- 6	—487	....	R-15	—900	....	R- 5	25
P- 5	—487	....	S-14	—898	....	S- 2	15
Q- 2	— 8	148	T-11	—726	....	....	....
R- 1	— 7	148	U-10	—726	....	....	....
S-Y	27	174	V- 7	— 6	250	....	....
T-V	0	0	W- 5	50	279	....	....
A-V	0	0	X- 4	50	278	....	....
....	....	....	Y- 1	0	0	....	....
V-W	13	60	1- 2	15	125	2- 3	10
W-X	— 7	19	2- 3	5	10	3- 4	0
X-Y	— 26	—213	3- 4	— 62	—295	4- 5	— 30
Y-Z	—216	—218	4- 5	— 37	— 75	5- 6	— 45
Z- 1	185	....	5- 6	—190	— 95	6- 7	—174
1- 2	51	—185	6- 7	138	30	8- 9	455
2- 3	—420	....	7- 8	—507	—480	9-10	—358
3- 4	— 35	....	8 -9	— 38	....	10-11	305
4- 5	310	....	9-10	468	....	11-12	—260
5- 6	—223	....	10-11	—178	....	12-13	45
6- 7	— 56	....	11-12	—215	....	13-14	—208
7- 8	— 21	....	12-13	— 27	....	14-15	205
8- 9	—191	....	13-14	12	....	15-16	—315
9-10	—161	....	14-15	—153	....	16-17	438
10-11	433	....	15-16	193	....	17-18	—435
11-12	— 3	....	16-17	— 11	....	18-19	620
12-13	—566	....	17-18	—373	....	22-23	180
13-14	70	....	18-19	—102	....	23-24	—127
14-15	193	....	19-20	585	....	24-25	90
15-16	—242	....	20-21	0	....	25-26	— 70
16-17	—199	....	21-22	—587	....	26-27	48
17-18	68	....	22-23	— 28	....	27-28	— 46
18-19	—106	....	23-24	178	....	....	....
19-20	29	....	24-25	—200	....	....	....
20-21	— 56	....	25-26	—203	....	....	....
21-22	11	....	26-27	108	....	....	....
22-23	— 33	....	27-28	—132	....	....	....
23-24	0	....	28-29	56	....	....	....
....	....	....	29-30	— 70	....	....	....
....	....	....	30-31	26	....	....	....
....	....	....	31-32	— 36	....	....	....

Loading 1 is triangular with apex one-third way hack.
Loading 2 is triangular with apex at leading edge.
Loading 3 is triangular with apex one-fourth way back.

TABLE VII

Test Data on 15-Foot Truss Ribs

Ribs.	Maximum load.	Deflection at center.	Deflection at trailing edge.	Failure.	Alterations for next test.
595–1	1,000	0.292	0.170	Column failure in member 2-3.	Member 2-3 reinforced in both directions.
	1,000	.273	.185	Member 5-6 heavily stressed.	Member 5-6 reinforced in plane perpendicular to rib.
	900	.241	.150	Member 8-9 bent in plane of rib.	Member 8-9 reinforced in plane of rib.
	1,170	.301	.188	Member 12-13 failed in plane of rib.	Member 12-13 reinforced in plane of rib.
	1,000	.305	.129	Member 12-13 failed in plane of rib.	Member 12-13 reinforced heavier and flange of lower chord members Q-2, P-5, O-6, N-9, M-10, L-13, and C-4 reduced in depth ¼ in. to $\frac{3}{16}$ in.
	1,000	.285	.098	Member 0-6 deflected greatly perpendicular to plane of rib.	
	1,175	.340	1.29	Member 5-6 failed in plane of rib.	
595–2	800	.219	1.50	Member 2-3 heavily stressed in plane of rib.	Member 2-3 reinforced in plane of rib.
	850	.208	.165	Apparatus broke.	
	1,070	.290	.234	Member 5-6 failed in plane of rib.	Member 5-6 reinforced in plane of rib.
	1,100	.329	.250	Members 8-9 and 16 - 17 deflected heavily in plane of rib.	Members 8-9 and 16-17 reinforced in both directions.
	1,200	.335	.248	Member 18-19 deflected perpendicular to rib.	Member 18-19 reinforced by adding another reinforcement strip in plane perpendicular to rib. Members P-5 and O-6 had web cut down ¼ in. and cap strip between wing beams reduced to ¾ in. width.
	1,200	.352	.208	No failure.	Members P-5 and Q-2 reduced web $\frac{3}{16}$ in.
	1,125	.320	.174	Member P-5 failed in plane of rib by combined bending and compression.	Member P-5 reinforced.
	750	.215	.117	Member 5-6 deflected heavily in plane perpendicular to rib.	Reinforcing of 5-6 made heavier.
	1,200	.384	.165	No failure.	
595–3	675	.350	.100	Member 19-20 deflected in plane of rib.	Member 19-20 reinforced by ¼ by $\frac{3}{16}$ in. strips.
	850	.388	.140	Tension failure in 9-10.[1]	Put additional strip ¼ by $\frac{3}{16}$ in. on other side of 9-10.
	600	.264	.100	Tension failure in 9-10.[1]	9-10 member reinforced.
	1,200	.580	.310	Member 17-18 deflected heavily perpendicular to plane of rib.	
595–4	820	.430	.190	Tension failure in 19-20.[1]	Put additional reinforcing strip on 19-20.
	610	.285	.120	Tension failure in 19-20.[1]	19-20 reinforced full length.
	800	.399	.078	9-10 near tension failure.	9-10 reinforced full length.
	1,100	.515	.140	17-18 deflected perpendicular to plane of rib.	
595–5	800	.290	.095	9-10 deflected heavily perpendicular to rib.	Heavier reinforcing on 9-10 perpendicular to rib.
	1,000	.375	.055	11-12 deflected heavily perpendicular to rib.	Heavier reinforcing on 11-12 perpendicular to rib.
595–5	1,200	0.454	0.128	15-16 deflected heavily perpendicular to rib.	
595–6	1,200	.485	.238	15-16 deflected heavily perpendicular to rib.	

[1] Tension failure due to very poor gluing.

of the rib and perpendicular to the plane of the rib are given, though failure occurred in one plane only. The low values in several cases for the coefficient in the plane of the rib were probably due either to severe strains produced by previous failures or to bending moments transferred from the chord members through the plywood at the joints. For future design work it is recommended that fixity coefficients of 1.25 perpendicular to the plane of the rib and 2 in the plane of the rib be used. These are conservative rather than average values. In computing web members the effective area of the plywood as determined from the charts in figure 15 should be used. In figure 16 are given column curves plotted for the above coefficients to be used in the design of web and chord members.

It is recommended that a fixity coefficient of 2 in the plane of the rib be used in the design of chord members. Any eccentric moments due to initial curvature of the chord between panel points or caused by deflections resulting from the lateral loads may be neglected. The wing covering may be assumed to prevent deflection perpendicular to the plane of the rib. A column length equal to 0.25 the sum of the panel lengths on each side of any panel point should be used in investigating the strength of the chord at such points. It is also permissible to consider the actual section of the chord at panel points, instead of the normal section, as effective in taking the peak of the bending moment. Care should be exercised, however, in computing the strength of the chord at a section an inch or so to either side of the panel point where the normal chord section begins.

The allowance of reasonably generous fillets at all joints is important, especially for members carrying large tensile stresses. The radius of fillets between members at about 45°

TABLE VIII

Rib.	Ultimate load.	Original weight.	Estimated weight.	Load. / Weight.
	Pounds.	*Ounces.*	*Ounces.*	
595-1	1,175		. . .	
2	1,200	51.7	52.2	23.0
3	1,200	48.5	46.0	26.1
4	1,100	47.4	41.9	26.7
5	1,200	59.6	57.1	21.0
6	1,200	58.0	55.5	21.6

to each other should not be less than ¾ inch. If the fillet is between two members which are nearly at right angles the radius should not be less than 1½ inches. In the case of heavily stressed members these minimum radii should be 1 and 2 inches, respectively. The tangents points of fillets on each side of a member should be opposite each other. In general, fillets serve to stiffen the members and to aid in transferring stress from the reinforcing strips on the web members to the plywood web. The normal section of a web member should not be reached until the stress in the reinforcing strip has been developed through the glue. The stress on the glue should not exceed 1,000 lbs./sq. in.

General Conclusions

The comparisons made in this report show that the reinforced ply-wood truss type of rib construction is probably superior to any other type of wood construction so far developed. The simplicity and low production cost of this rib are its most essential features. These features are due to the small number of parts to be handled, the fact that none of the members have to be jointed or fitted, and that all the web members are of uniform section throughout their length. There is none of the work of putting in screws or wrapping and gluing all the joints. The amount of ply-wood wasted is, of course, large, but its cost is small in comparison with the reduced cost of the labor.

These ribs are very stiff and rigid in comparison with other types, as shown by the deflections in Tables II, IV, and VII. The strength: weight ratio of these ribs is higher for a given chord length than for any other type except the Barling, which is expensive to build. With the information now available relative to the design of these ply-wood truss ribs their strength can be accurately computed, making a test almost unnecessary. Their strength is very uniform provided a reasonable amount of care is taken in the gluing. As is the case with all type of built-up ribs, the gluing must be about 50 per cent efficient. Two points should be emphasized if the gluing is to be reliable: First, the glue and water must be carefully weighed out in the proper proportions and thoroughly mixed; second, sufficient glue must be applied to both surfaces of the joint, and then as much of this glue as possible squeezed out of the joint by nailing on the reinforcing strips with fairly heavy brads. More of these brads should be used near the ends of the web strips than in the center. No difficulty has been experienced in the joint between the cap strips and ply-wood. It is believed that a spruce-poplar ply-wood is superior to a birch-poplar ply-wood of the same weight. One of the chief reasons for this is that a better glue joint can be made with the lighter ply-wood.

The tests on these ribs indicate clearly that a moderately shallow rib can be constructed with a weight equal to or less than that for a rib with a deep section.

Although the tests showed no difference between the strength of ribs of the subdivided Warren truss type and those of the Pratt truss type, it is believed that the former are better. In production the attachment of the ribs to the spars could not be as good as in the ribs tested. For this reason a compression member adjacent to the spars is superior to a tension member, as the latter type is much more difficult to hold in place.

For production reasons, it is recommended that further work be done on the development of reinforced ply-wood truss ribs with all the reinforcing in the chords and web on one side only. Because of eccentricities such a rib would not be as efficient as a symmetrical one.

It is also recommended that the Martin type of construction be developed for short ribs of deep section.

TABLE IX

Data from Sections of Chords Tested in Bending Span 18 Inches; Loading Third Point.

Rib No.	Chord No.	Cross section.			Net section.		
		Moment of inertia.	Modulus of rupture.[3]	Modulus of elasticity in 1,000 lbs.	Moment of inertia.	Modulus of rupture.[3]	Modulus of elasticity.
595-1	S-16 and I-18.	0.01318	12,200	1,630	0.00989	16,200	2,170
2	N-9 and M-10. .	.01823	11,910	1,605	.01365	15,900	2,140
2	O-6 and N-9. . . .	.02055	[4]8,040	1,423	.01544	[4]10,400	1,895
3	U-10 and T-11	.05627	11,100	1,292	.01239	14,550	1,718

[1] Full cross section of chord.
[2] Cross section of chord without the vertical lamination of web.
[3] Modulus of rupture in tension
[4] Brashy specimen.

TABLE X

Fixity Coefficients for Web Members

Rib.	Member.	Perpendicular to plane of rib.	In plane of rib.	Load at failure.
1. . .	2-3	[1]1.4	2.8	1,000
1.	5-6	1.2	3.4	1,000
1. .	8-9	. . . .	1.8	1,000
1. . .	12-13	[1]1.55	1.7	1,000
2 .	2-3	. . . .	2.3	800
2. .	5-6	[1]1.3	3.6	1,070
2. .	8-9	. . . .	2.0	1,100
2. .	16-17	. . . .	3.3	1,100
2. .	18-19	1.35	. . . .	1,200
3. . . .	17-18	.95	[1]1.85	1,200
4. . .	17-18	.8	[1]1.7	1,100
5. .	9-10	1.6	[1]2.8	800
5. . .	11-12	1.4	. . . .	1,000
5. . . .	15-16	1.5	. . . .	1,200
6. .	15-16	1.5	. . . .	1,200

[1] Failure not in this plane.

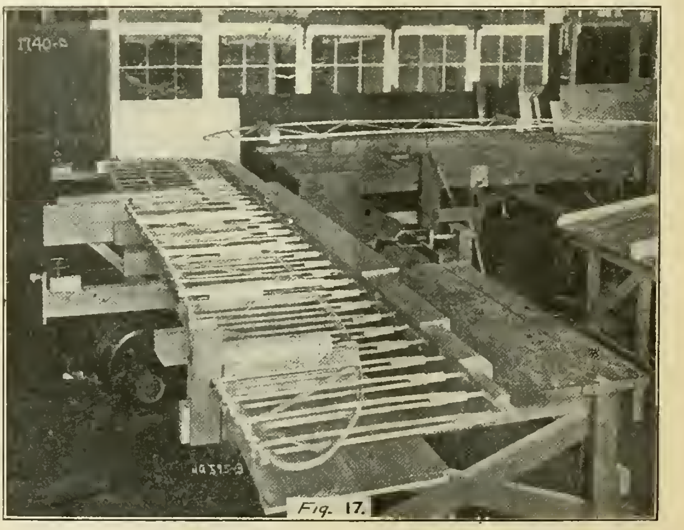


Fig. 17.

NAVAL and MILITARY AERONAUTICS

Night Bombing Work at Langley

Night flying is the program on in full force by the men of the Provisional Air Brigade stationed at Langley Field. Experimental flights are being made every night except Thursday, Saturday and Sunday with a view to familiarizing the pilots with the use of flares and operation of the new Sperry device for ascentaining horizontals and relative positions of aeroplanes while flying at night or through heavy clouds or fog.

The present program is being carried out preparatory to the bombing exercises now scheduled to take place in the early part of September, when army aeroplanes will once more have an opportunity to demonstrate their efficacy as weapons of offense against battleships, this time by locating and sinking an armored vessel at night.

The U. S. S. Alabama is the ship set apart for this phase of the bombing maneuvers. While it is not known at this time whether the ship is to be anchored or under power, it is said that the successful carrying out of the project in either case will be the strongest possible argument in behalf of the practicability of air craft as a military weapon.

Airships May Fly Across Continent

Across the continent to California and thence to Nome, Alaska, and return to California, is the contemplated flying program for two of Langley Field's airships, marking not only the first attempt at a transcontinental flight in lighter-than-air craft, but also the most comprehensive flying project as yet outlined for dirigibles in this country.

The D-3 and D-4, which are the ships designated for the big undertaking, are being thoroughly overhauled at Langley Field; new motors are being installed and a number of changes are being made, preparatory for the flight. The ships have been in constant use at the Field all summer, taking an important part in the bombing maneuvers conducted by the First Provisional Air Brigade, when they were used for observation and photographic purposes.

While the proposed trip will be of the utmost interest and value to those selected for the undertaking, it will also demonstrate the cruising ability of the present type of non-rigid airship. Only two landing fields, affording hangar space, will be encountered on the journey across the continent, one at Akron, Ohio, and the other at Brooks Field. Engineering and aerial navigating skill of the highest order will be rejuired to carry the ships over the mountains and across the plains successfully, while the subsequent flight into the far northland has all the glamor of romance and anticipation of discovery. Practically all officers of the lighter-than-air section of the Field have volunteered for the trip, although but a limited number will be required for the work.

Four officers and three enlisted men, including two engineers and one radio operator will be assigned to each ship. While final selection of the men for the trip has not been made at this time, it is said that Majors Strauss and Peek will probably be included as senior officers.

The change of station for the two ships is being made at this time, for two reasons: first, the arrival of the monster airship, "Roma" from Italy and designated for service at Langley Field, makes it necessary to remove some of the ships from the big balloon hangar in order to house the larger craft properly. In the second place, Ross Field is now being used for the primary training in airships, so that with the arrival of the D-3 and D-4 the complete airship training leading to rating as airship pilot, may be carried out.

Philippine Government to Relinquish Its Air Service

There is a possibility that the Philippine Air Service will be taken over by the Army or by a private enterprise, as the Insular Government is desirous of being relieved of the expense of maintaining the service. A conference between officials of the Army and the Philippine Government was held on July 8th with regard to the proposed transfer, but no decision was reached in the matter. A private company, of which E. J. Hamilton Stevenot is the head, is said to be making a bid for the aeronautical property of the Philippine Government, but until a proposition in writing is submitted no action can be taken thereon. Further meetings will be held between the Military and Insular authorities with a view to the ultimate settlement of this matter.

Airship Makes Trip to Camp Dix

One of Langley Field's big blimps, the C-2, under the command of Major Pagelow, who was accompaued by Major Strauss, Lieuts. Reed and Anderson and Sergeants Ryan and Gabriell, sailed into Camp Dix recently for the purpose of giving the West Pointers encamped at that place practical instruction in this branch of the service. During the time spent at Camp Dix, seventy cadets were taken up on flights.

Radio Activities

At Langley Field communication was established with Bolling Field and tests are being carried on in an effort to determine the best working wave lengths. While using 450 meters, undamped, Bolling Field comes in at this station loud enough to be read all over the room without keeping phones on, although this wave length is unsatisfactory for regular work with them as there is quite a bit of commercial traffic and, consequently, the interference is very bad. While using 830 meters undamped they are not so strong as on 450 meters, but there is less interference. As a result of the test, it has been decided that 350 meters is the most practicable wave for them to use. The 109 set was used in this test. In a later test, Bolling Field changed its wave to 750 meters, which makes reception of signals much easier, eliminating much of the interference made by ships in Hampton Roads.

At the request of the Air Mail Station at College Park, Md., this station is furnishing local weather reports twice daily. They report the successful reception of the same.

In Panama successful results with radiophones were obtained in a series of problems for the observation of fire for the coast defenses of Cristobal. Excellent one way communication was maintained throughout the majority of problems. As a preliminary to the firing of these problems an officer from each of the defenses firing was detailed at France Field for a short period of instruction. Many difficulties were encountered by both the Air Service and the Coast Artillery and practical demonstrations were given as to just how communication should be handled.

A central power plant is being developed with the generator directly connected to the engine. The results of test show that it is satisfactory as a source of electrical power for radio transmitting sets, but with the present apparatus cannot be used as a source of power for radio receiving sets. Until suitable apparatus is developed, a small storage battery will be used for the radio receiver.

A Warning to Pilots Flying at Mitchell, Roosevelt or Curtiss Fields

The Curtiss Aeroplane & Motor Corporation advises that the Air Mail have erected two wireless poles 150 feet high, about 100 yards north of the Curtiss factory at Garden City. Electric lights will be placed on these poles to avoid danger of collision at night.

Pilots using Mitchell, Roosevelt or Curtiss Fields at Garden City should take care in landing that they do not come so low as to collide with these poles.

More About the Radio Controlled Car

In a previous issue of Aerial Age we gave a description of the radio controlled car at McCook Field, the mystifying gyrations of which caused so much wonderment and comment amongst spectators who witnessed its performance. Just recently the citizens of Dayton were given an opportunity to witness the performance of this vehicle, which was operated through the downtown traffic directed by Captain R. E. Vaughn, of McCook Field, who designed and perfected the device.

Just at the hour when morning traffic is the heaviest, a little three-wheeled car, about eight feet long, of cigar-shaped construction, left the monument on North Main Street and made its way south, blowing its horn and observing all traffic rules. Vaughn guided the car solely by means of a wireless set installed in an automobile in which he followed the car at a distance of 50 feet.

At Fifth and Main Streets, the car turned east to Jefferson and North to Monument Avenue. Here motion pictures were taken.

The entire control of the car was brought about through the wireless antennae and outfit with which both machines were equipped.

FOREIGN NEWS

Swiss Military Air Service Records

The following information regarding Swiss air work is published:

12,380 flights of a total duration of 3,532 hours were carried out by the Swiss Air Force during 1920.

Accidents were as follows: 2 machines slightly damaged, 3 bad landings (machines standing on nose), 2 machines turned turtle (forced landings), 1 crash in getting off (machine totally wrecked).

No one was injured in these accidents, but there were two deaths as the results of crashes during non-service flights. The training of airmen, which included an average of 10 hours flying per month, paid special attention to the development of safety in flying.

Tokyo Civil Air Port

The Japanese authorities, it is announced, are making preparations for establishing an aerial port near Tokyo. Urawa, the capital of the prefecture of Saitama and situated at a distance of 30 minutes by train from Tokyo, is reported to be the probable site.

Mr. Hata, the Vice-Director of the Aviation Bureau, states that the aerodrome which is contemplated by the authorities is of an entirely different nature from the military aerodromes at Tokorozawa, Kagamiga-hara, etc., and is intended to be the first of many aerodromes of the kind to be constructed in Japan, Korea, Saghalien, etc. It is to comprise a training ground, landing-place, warehouses, customs house, hospital, wireless installations, a signal tower, etc., and also equipment connected with aviation at night to be prepared according to the requirements of the Air Convention.

As this new air port will be placed under the control of the Imperial Japanese Aviation Bureau, it would become an important military organ in time of war. In time of peace, however, it will be a welcome training ground for civil aviators, who have long felt the necessity of such a ground.

Commercial Aviation in Morocco

In the Report, dated May, 1921, on the Trade, Industry and Finance of Morocco, issued by the Department of Overseas Trade, is the following reference to Commercial Aviation: The State-subsidized aerial, mail and passenger service, established in 1919 by the Compagnie Latécoère between Toulouse and Rabat, the administrative capital of the French Zone, was extended in 1920 to Casablanca, whilst the service was increased from eight flights a month to four a week, and will soon be made a daily one. The service has worked with most commendable regularity, and it is a great boon to business men to be able to travel from Casablanca to Paris in forty-eight hours. The route followed on leaving Casablanca is Rabat, Malaga, Alicante, Barcelona, and Toulouse, which latter is reached on the afternoon of the day following the departure from Casablanca, in time to catch the evening express to Paris.

The passenger fare is about fr. 1,600 for the full flight from Casablanca to Toulouse, whilst letters pay a surtax of 1.25 francs.

The First Naval Air Unit of the British Overseas Dominions

To Australia belongs the distinction of being the first among the British Overseas Dominions to establish definitely a Naval Air Service. It has been known for some time in the Aircraft Industry that the Australian Government had placed a quite considerable order for seaplanes with the Fairey Aviation Company Ltd., of Hayes. The first half-squadron of these is now ready for delivery, and the first machine of the Unit, which is very properly numbered A.N.A.1 (Australian Naval Aircraft 1) is to be launched on Saturday next from the Fairey Company's works at Hamble, on Southampton Water.

The machine will be launched by the Australian Prime Minister, the Right Honorable W. M. Hughes, and our old friend General Seely, who is Member for the constituency in which Hamble is situated, will preside at the inaugural luncheon given by the firm in conjunction with Rolls-Royce Ltd., with whose engines the first Australian Naval Aircraft are fitted.

Aviation in Italy

A group of fifty Representatives has been created in the Italian House of Representatives that has called itself the *"Group of Aeronautics."*

The President of the group is Hon. Turati, the well known Socialist leader; the Secretary is Hon. Finzi, the gallant pilot who took part in the raid on Vienna during the war.

The group will study and develop all aeronautical questions, but its most important work will be the organization of commercial aeronautics and international aerial navigation.

In the meetings they have considered the bills to be approved by the House concerning aeronautics and the ratification of the International Convention of Aerial Navigation.

Hon. *Gasparetto,* who was one of the most active members of the group, is now Secretary of War and this will signify a great improvement in civil and military aviation in Italy.

Second Prague Exposition

The second annual International Aircraft Exposition will be held in the Palace of Industry, Prague, from October 22nd to 30th. The exhibition will be under the patronage of President T. G. Masaryk.

Aeroplanes, balloons, airships and engines, together with parts and materials for their construction, as well as the apparatuses, tools and other articles used in aircraft manufacture will be exhibited.

The great success which attended the First International Exhibition in Prague, 1920, has encouraged the Club to arrange yearly exhibitions, and has assured it that all firms interested in aeronautics will take advantage of the opportunity this offered for them to show their products.

Up to now there is a regular air-service between Paris-Prague-Warsaw, and in a short time a similar service is to be opened between Berlin-Prague-Vienna.

Prague is geographically the chief point in Central Europe as well as the center of all Slave commerce and therefore will certainly hold the leading position in aeronautics.

At the conclusion of the exhibition a special festival will be arranged in order to give exhibiting firms an opportunity of showing, in a practical manner, viz.: flying, the qualities of their machines. This will be arranged for the 6th of November.

British Airman's Exploits in Spain

The exploits of Major de Havilland, the well-known "Bristol" aeroplane pilot, are sharing public attention in Spain with the Moroccan operations. Immediately upon the outbreak of hostilities an enterprising journal of Madrid, *"La Libertad,"* immediately obtained the use of a "Bristol" Tourer under the pilotage of Major de Havilland, and despatched their war correspondent to the scene of operations. After a lengthy flight the machine reached the aerodrome upon which they intended to alight, only to find the whole place occupied by the enemy.

Flying ten feet from the ground the "Bristol" pilot circled around their positions scattering the enemy in all directions and then, after a further flight of 120 miles across the sea, landed safely in Almeria. Next morning the machine was back in Madrid and the correspondent was able to bring off the biggest news "scoop" of its kind in Spanish history. The distance covered in twenty-four hours was probably in the neighborhood of 1,000 miles. The present-day position of Major de Havilland, feted on all sides with true Latin fervor, is not without embarrassment for the Englishman who declares that he heartily wishes he was back in Africa.

Lieut. Parer Abandons Australian Flight

In his proposed flight from Melbourne on a 10,000-mile flight round Australia, Lieut. Parer did not, unfortunately, get very far. He started on August 3 from Melbourne, in a gale, and about 40 miles out he ran into a blinding snowstorm. As his engine was running badly, he determined to descend. Having landed safely, he was standing near his machine, when a blast of wind tilted the machine and threw him against the whirling blades. His collar-bone was fractured, and he received injuries to his leg and toes. He is now in hospital.

Advertising German Air Mail Services

The Stuttgart postal authorities have recently brought in a new regulation as a means of propaganda for the Stuttgart-Constance-Switzerland air mail service. Between June 15 and July 30 letters were carried by way of experiment on the route in question at the ordinary postal fees, the usual additional air mail fee not being required.

The service was carried out in such a way that express matter received precedence over other matter for transport by aircraft. Bundles of printed matter and newspapers and other cumbersome postal matter, with the exception of express matter, were ruled out.

Two-thirds of the mail in question was forwarded by air, and one-third was held back and despatched in the usual way. By this means the Stuttgart postal authorities hoped to bring home to the public, who are in the habit of sending their mail by the usual channels, the advantages of the air mail service. The usual air mail matter—that for which the additional air mail fee has been paid—naturally received precedence over other matter.

The Schneider Cup Race at Venice

From being a keenly-contested event, the annual race for the Schneider Cup seems to have degenerated into a sort of one-man show, in which no one takes any particular interest. In the years before the War one could always be certain of seeing representatives of at least three countries at the seaplane race of the year. Now the entries are few and far between, and often those which do turn up manage to get deleted in the preliminary tests. In a great measure this country must be held responsible for this state of affairs, not by any sins of commission (unless one so classes the unfortunate affair at Bournemouth in 1919), but rather by sins of omission, by refraining from sending any representatives to the race last year, and again this year. This is all the more regrettable, as this country has all the requirements for becoming the world's leading seaplane power. Our seaplanes are second to none, but we do not seem to realize their possibilities in the development of commercial aviation. It is true that the Schneider Race is a speed event, pure and simple, but even so the lessons learned and the experience gained would be invaluable to the designer of commerical types. The present state of the country's finances is mainly to blame, but we cannot help thinking that with a little good-will the Royal Aero Club and the S. B. A. C. between them ought to have been able to send representatives to Venice this year.

Last year the race was a walk-over for Italy, there being no foreign competitors for the Cup, which was won by Bologna on a Savoia. This year one French competitor was entered—Sadi Lecointe, on a Nieuport with 300 h.p. Hispano engine; but we regret to learn that he had bad luck in alighting after a test flight, damaging his undercarriage to such an extent as to preclude his taking part in the race.

The question now arises whether or not Italy is to retain the Cup. By the rules of the competition the country which has won the cup three times in five years has the right to retain it. After the lamentable affair at Bournemouth in 1919 it was at first stated that Janello on the Savoia had failed to round one of the mark boats properly, but ultimately it was decided to give the Italian Aero Club the custody of the Cup, and to hold the next race in Italy, under the organization of the Italian Aero Club.

If Janello is declared to have won the 1919 race properly—as we think he ought to be if there was sufficient doubt in the minds of the Royal Aero Club officials to let the Cup and the race for the following year go to Italy—it would appear that Italy becomes the permanent holder of the Schneider Cup—in which case we shall probably have to write *finis* to the annual Schneider races.

Perhaps in that case some other public-spirited sportsman may be found to present a new Cup.

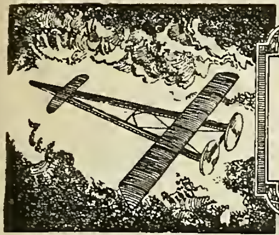
As regards the Schneider race this year, Sadi Lecointe was the only foreign competitor entered. As we have already said, he had the misfortune to crash his undercarriage (it does not appear to have been the floats themselves in this case) after a test flight. This left only the three Italian competitors. It is of interest to note that no less than ten Italian machines had been entered for the race. The eliminating trials left three competitors for the actual race. These were:

Briganti on a Macchi flying boat, type VII, with 200 h.p. six-cylindered Isotta engine. This machine has an aera of 215 sq. ft.

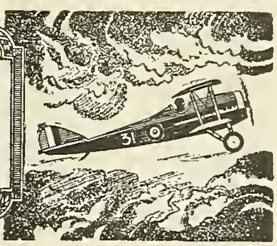
Zanetti was flying a considerably larger machine, viz., a Macchi, type XIX, with a 12-cylindered Fiat engine of 700 h.p., with a wing aera of 485 sq. ft.

Corniglio was flying one of the Naval flying boats with 250 h.p. Isotta engine and a wing aera of 290 sq. ft.

In the actual race two of the competitors dropped out. Zanetti's machine caught fire, but happily he and his mechanic were rescued. Corniglio ran out of petrol and had to abandon the race. This left only Briganti on the smallest machine, who completed the course at the average speed of 119 m.p.h.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Plans for Building Compressed-Air Model

MORE complete details are given herewith to supplement the notes and photograph of the Fastje compressed-air driven monoplane model which appeared in the July 11th issue.

This model, designed by Mr. Carl H. Fastje, of Dennison, Iowa, has a five-foot wing span and a nine-inch chord. The power plant is a two-cylinder opposed, having a five-eighth inch bore and a five-eighth inch stroke. The streamline compressed-air tank has safety and inlet valves at the front end. The tank is twenty-six inches long, 2¾ inches in diameter at the front end, tapering in a straight line to 1¾ inches near the end, where a streamline finishing cap is located. The motor specified is one obtainable from the Wading River Manufacturing Company; the tank may be obtained from the Model Machine Shop Company, 415 East 71st Street, New York City. Blue prints of the model drawn at a scale four inches to the foot, together with full sized details of all the principal parts, can be obtained from Mr. Fastje at moderate cost. The drawing shown below gives a general idea of the proportions of the model; it was drawn up by Mr. Fastje especially for publication in AERIAL AGE. It is interesting to compare the drawing of the plan view with the photograph previously shown.

Main Planes

Spars are of ¼" round white pine or similar wood. Ribs are made of balsa wood ⅛" thick or they can be made of white pine 1/16" thick. The wing section used is the U. S. A. No. 5. The method employed in making the ribs from balsa wood is to draw the wing curve on a block of balsa wood marking the positions of the spars and leading edge. The holes for the spars and leading edge are then drilled out absolutely perpendicular to the face of the block of wood. The block is then sawn out to the wing curve on a band saw. Then the wing curve lock is passed through a circular saw, making each rib ⅛" thick and exactly alike. Each wing exactly 28½" long.

The leading edge is made of 3/32" round split bamboo. Ribs are slipped on to the spars and glued in their proper places. The leading edge is secured to the ribs by drilling a 1/32" hole in the rib about ⅜" from front end and tieing with thread by passing it through the hole with a fine needle. The scalloped trailing edge is made by using No. 34 tinned wire. Rear ends of ribs are wrapped with fine thread, then a hole is drilled through with a number 61 drill, and a fine slit made in the end of the rib in which the wire fits. The wire is then secured with thread and glued.

A cross brace should be inserted between the two inner ribs so that the trailing edge wire will not bend the ribs when it is fastened on and also when the silk covering is doped and varnished. The covering is the best Japanese silk, doped and finished with bamboo varnish.

Tail Planes

The tail planes are constructed in similar manner as the main planes, with double cambered ribs. The rudder is made to fit into two ribs of the stabilizer plane, which holds it fast. The spars are 5/32" round wood and the ribs are made of balsa wood in the same manner as the main plane ribs are made and are 3/32" thick, and the leading edge is made of 1/16" round bamboo. The cross-braces between the ribs are also made of balsa wood and must not be omitted or the wings will warp badly out of shape when the silk covering is varnished.

Fuselage

Longerons are of ½ x ¼ inch white pine or spruce. They taper to a ¼" square at the rear end from the midway point. The longerons are exactly 42" in length. They are parallel to each other from the front ends to the front end of the tank. The tank is secured to the longerons according to the detail view in the drawings. The motor can be of any kind, but the two-cylinder opposed motor as drawn is secured by two strips of sheet aluminum passed over the cylinders and bolted to the longerons. The cabane struts are ⅛" round aluminum rod.

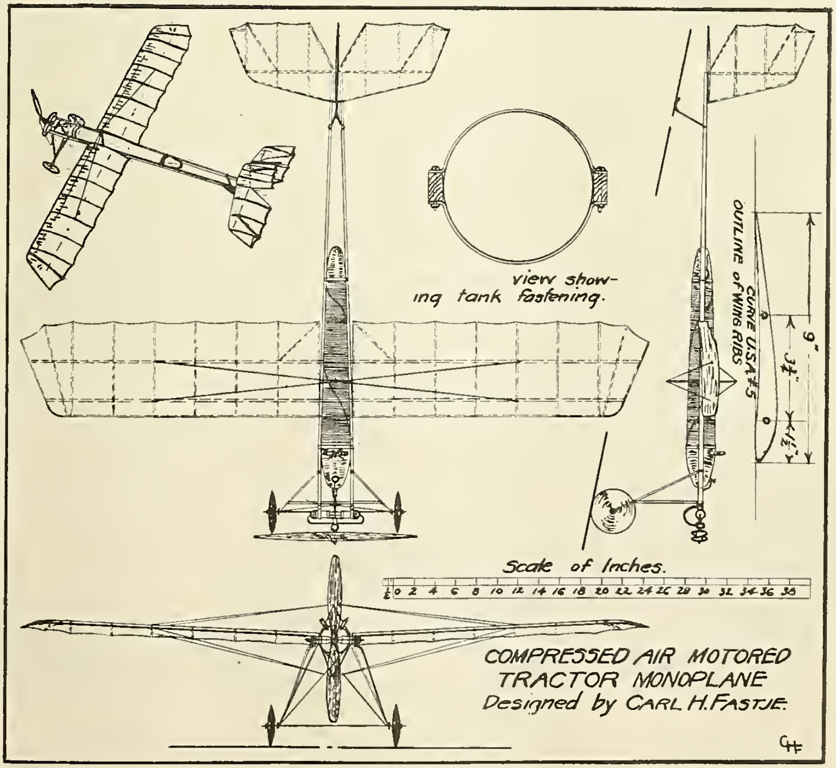
Landing Gear and Tail Skid

The landing gear struts are made of split bamboo ¼" wide and ⅛" thick, streamlined. The axle is ⅛" diameter aluminum rod. Wheels are made of balsa-wood 4" in diameter, well streamlined. A piece of ⅛" inside diameter brass tube is used for the hub and is secured to the wheel by soldering a brass washer to it on each side of the wheel.

The tail skid is made of 3/16" x 3/32" split bamboo, streamlined. It is split for half the length and bent open to permit it to be attached to the longerons by thread and glue.

Propeller

The propeller should be from 14 to 16 inches in diameter and of rather low pitch. The best size can be found by experiment. The main plane and landing gear bracing wires are 26 gage brass.



COMPRESSED AIR MOTORED TRACTOR MONOPLANE
Designed by CARL H. FASTJE.

A-E-R-O-N-I-T-I-S

The Lovely Comrade

(*Miss Laura Bromwell, who was killed by a fall from her aeroplane on June 5, 1921, was known among her fellow aviators as the "Lovely Comrade."*)

Above the flatness of the sunburnt field
  In her swift plane her untaught hands grew tired;
She dared the upper spaces and with us
  Conquered them, side by side.

And always for the merry, fearless heart
  Her flyer's well-worn leather coat concealed,
We came to love her better every day,—
  Our Lovely Comrade of the flying field.

On joyful wing cleaving the high, bright air,
  No more her speeding plane goes venturing;
She has outsoared us in her dream of flight,
  She has outstripped us in her piloting.

Yet still above the level, stretching field
  We challenge as of old the gods of Space,
And seem beside us as of old to see
  Our Lovely Comrade's merry, laughing face.

—*By a Fellow-Aviator.*

Tennessee—May Ah see you-all home?
New Jersey—You're drunk, man, there's only one of me.
—*Punch Bowl.*

Here It Is—There It Isn't

She: Jack is in love with you.
Her: Nonsense!
She: That's what I said when I heard it.
Her: How dared you!—*Cornell Widow.*

The Apple of His Eye

A peach came walking down the street;
  She was more than passing fair;
A smile, a nod, a half-closed eye,
  And the peach became a pair.

—*Cornell Widow.*

Financially Educated

"What did your son learn at college?"

"Well, sir, he can ask for money in such a way that it seems like an honor to give it to him."—*Virginia Reel.*

Why He Had It

Gob: Say, Doc, I have sores all over my feet, and mouth is sore too. What is it?

Doc: Let me see. Oh, yes! It's a bad case of the hoof and mouth disease.

Gob: Why, I thought only cattle were affected with that!

Doc: Sure; but you've been throwing the bull so much, you contracted it.

So Playful

"A man on first and third," said he,
  "Here's where we work the squeeze."
"Oh, Charlie, dear, not right out here,
  It is so public, please!" —*Proofs.*

Page Sherlock Holmes

Customer: "Waiter, I don't understand about this trouser button being in my soup."

Waiter: "I don't either, sir. We employ only women in the kitchen, sir." —*London Mail.*

Scene: Aeroplane hangar, Irish mechanic busily engaged in shaping a spar with a jack knife.

Asst. Foreman: "Why don't you try (i) plane?"

I. M.: "I haven't got ere a plane."

A. F.: "Well, buy (i) plane."

Foreman: "For the love of Mike, lend the mon a plane."

A Clean Joke

"May I hold your Palm, Olive?"

"Not on your life, Buoy!" —*Ex.*

He Was Wrong

"I don't believe the negro race is naturally eloquent," remarked the northern visitor.

"Sir," replied the old-fashioned southern gentleman, "you have probably never heard a colored bootblack addressing a few appropriate remarks to a pair of dice."

—*Birmingham Age Herald*

The Officer's Mistake

Officer-in-charge of Rifle Range: "Don't you know any better than to point an empty gun at me?"

Raw Rookie: "But it ain't empty, sir; it's loaded."

—*The Mirror.*

Officer (drilling recruits): "Hey, you, in case of fire, what do you do?"

Recruit: "I yell."

"Yell what?"

"Why, what do you suppose? Cease firing!"

—*Le Rire (Paris).*

Had a "Miss"

Coxswain of 1st Motor Boat: "Have you a little fairy in your home?"

Engineer of 1st Motor Boat: "No, but I have a little miss in my engine."

The Way You Say It

Yeoman: "I was shot in the wrist."

B. M.: "Did it wound your wrist?"

Yeoman: "No, you simp, it wound my wrist watch."

—*Phillips.*

Landing

By George J. Gould

I had a girl named Josephine,
  We took a ride in my air machine,
We climbed up, five thousand high,
  Until she thought she'd reach the sky.
Sailing along at a hundred per,
  She winked at me and I at her.
All of a sudden something smashed!
  Then I heard an awful crash!
When I came to my senses,
  I was wrapped around barbed wire fences.
Then I looked around to see,
  Where she landed in a tree.
When at last she reached the ground,
  And found she was all safe and sound,
She hauled off and knocked me flat,
  And she told me she wouldn't play if we had to land like that.

"We went up on high,
In a J. N., we fly
And when we came down
Everyone could hear the sound." —*"Rupe."*

When aeroplanes become so common that they do not bother the man with a boil on the back of his neck

HARDIN PARACHUTE

Phoebe J. Fairgraves
918 Fuller Ave., St. Paul, Minn.

Holder of World's altitude record for women parachute jumpers, 15,200 feet

Date: July 10, 1921.
Type of ship used: Curtiss Oriole.
Curtiss Field, St. Paul, Minn.
Pilot: V. C. Omile.
20 minutes to reach ground after leaving ship.

HARDIN PARACHUTE USED.

Miss Fairgraves says of her experience:

> "At 15,200 feet it was terribly cold, about 10 degrees below zero, and it took all the courage that I could muster to step from the cockpit and pull the release cord. I was expecting a long drop on account of the height and the lightness of the atmosphere but the parachute opened as soon as I left the ship. When nearing the ground I was headed for some high tension wires but a pull on one side of the chute and I slipped away from the wires without any trouble."

At the Red Oak, Iowa, Meet, June 25, 1921, Paul Duncan, of North Platte, Neb., won a silver loving cup for spot landing with a Hardin Parachute, landing within a short distance of the spot from an altitude of 2300 feet.

In addition to our life pack we manufacture exhibition chutes in single, double and triple drops. Write for catalog and new price list.

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The Navy is offering the following Surplus Photographic Material for sale by fixed prices. All the material is up to Navy Specifications and is NEW and UNUSED.

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SALE PRICE $50.00

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B. & L. No. 9, **$50.00**
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Developing and printing acids and chemicals, frames, tanks, trays, racks, developers for motion pictures, slides and numerous other items of interest to the amateur and professional photographer.

All the above material is located at Naval Aircraft Factory, Phila., Pa.

This material is listed in the illustrated and descriptive catalog on Aeronautical Equipment.

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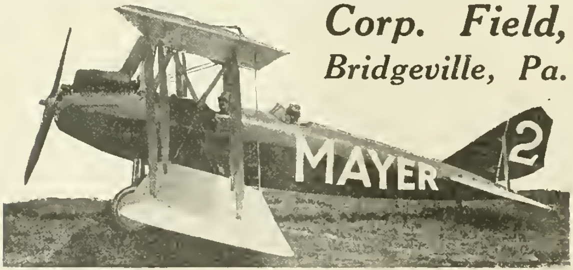

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Spar Varnish, 5 Gal. cans, $2.25 per Gal.

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TYCOS ALTIMETERS, register 20,000 feet radius, $15.00 each.

New Leather Aviation Helmets, $5.00 each, cost $18.00.

½" Brass Gasoline Stop Valves, $6.00 per Doz.

AC Spark Plugs Metrics $3.00 per Doz. $20.00 per hundred. $180.00 per M.

4" Barrel Turnbuckles $3.00 per Doz. $15.00 per hundred.

Wicker Pilot Seats, $4.00 each, $36.00 per Doz.

Tufted Fabricoid covered cushions for above $1.25 each.

Size No. 2½ Tinned Tacks, 15c per lb.

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Canuck Wings { Uppers . $120.00
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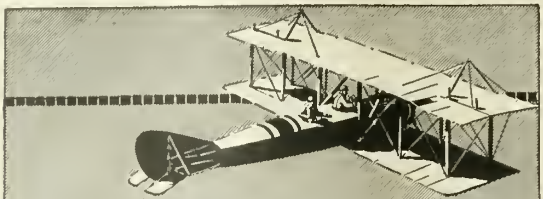

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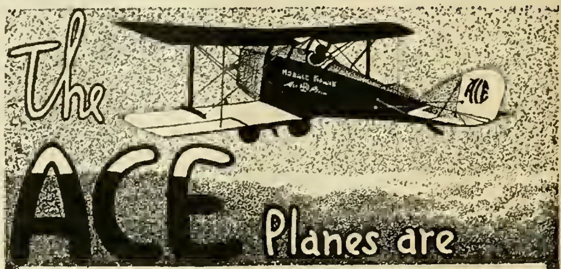

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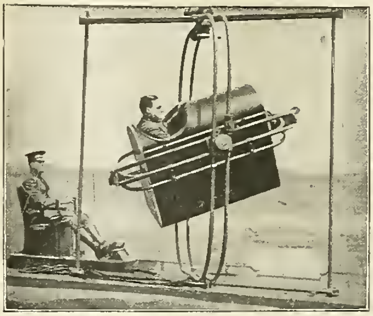

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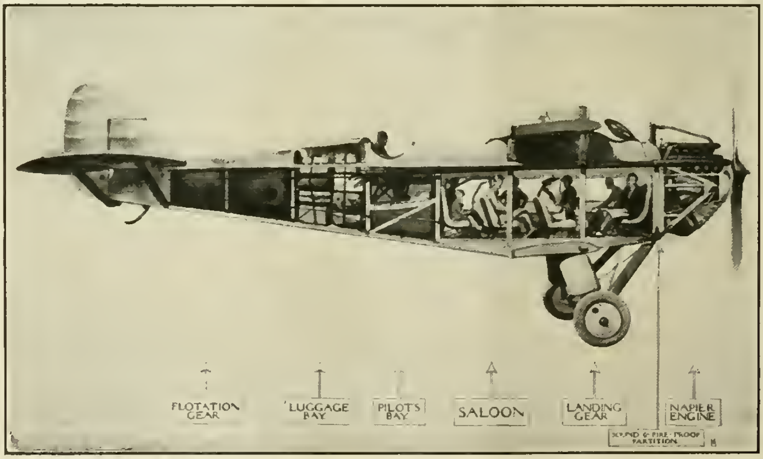

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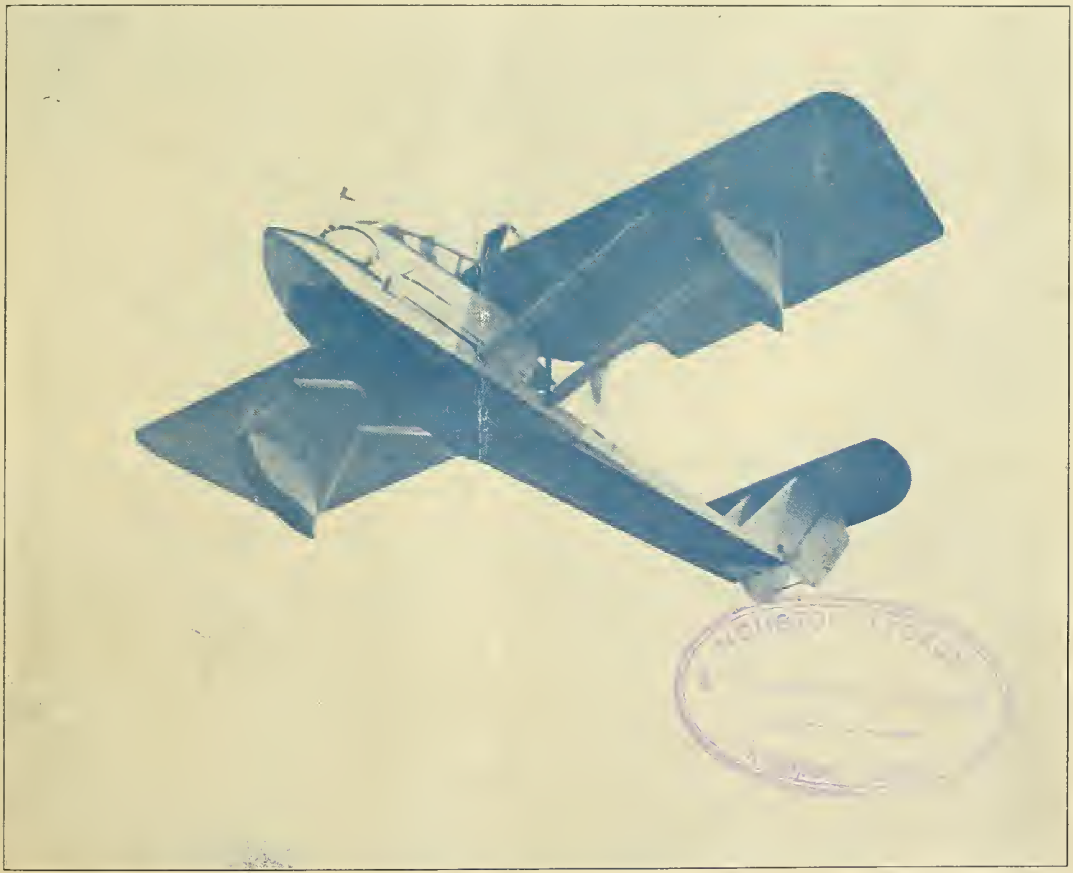

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Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

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By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

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By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

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TABLE OF CONTENTS

The Dirigible Disaster 607
Air Laws 607
The News of the Week........... 608
The ZR-2 Disaster 611
The Loening Monoplane Flying Boat 613
Report of Joint Army and Navy Board on Bombing and Ordnance Tests 614
The Barnhart Twin No. 15 Wampus-Kat 615
The Employment of Airships for the Transport of Passengers......... 618
Aero Club of Pennsylvania......... 620
Naval and Military Aeronautics.... 621
Foreign News 622
Elementary Aeronautics and Model Notes 623
Aeronitis 624

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G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
G. F. McLAUGHLIN
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

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Flying

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The Dirigible Disaster

THE destruction of the ZR-2 came at a time when the outlook for flying was exceptionally bright. Army and navy officials in the United States had taken a new attitude toward it. Experiments looking toward radio-driven torpedoes, controlled from the air, had been announced. The Gallaudet triple-motor drive promised much. Finally the casual message of the ZR-2 itself, flashed to its station by radio, that the weather might be better for landing in the morning and they would stay up for the night, had indicated the remarkable control men had achieved over the air and the comfortable feeling of an airship crew toward it.

Immediately upon these developments came the supposed buckling of the gigantic frame, the explosion, the death of forty-three men, and the total loss of the $2,000,000 dirigible built by England for the United States. Sixteen Americans perished, and Commander Maitland, the dominating personality in the field of lighter-than-air navigation in Great Britain, is among the twenty-seven British who died with them.

There have been questions asked as to why the United States was buying a dirigible from England, or why she wanted one at all. There have been hinted criticisms of the design, the soundness of construction, the wisdom of attempting the flight without further factory tests. All these have arisen in the excitement of the moment; some have point and some have none.

The airship is a part of naval equipment which no modern nation can neglect. The Zeppelins were not, on the whole, a success, but lighter-than-air craft constitute a potential aerial strength which the United States could not overlook.

Great Britain had experience and facilities which we had not, and Washington was wise in getting a sample of the work which had sent the first airship across the Atlantic. As to design and construction, we shall get little true news. The international aspect of the affair will work against frank expression of opinion by Americans, and the British will be on the defensive.

It seems certain, of course, that more factory tests should precede long flights, and that an economical non-inflammable gas like helium should be developed as rapidly as possible.

But post-mortems cannot undo the most terrible and costly accident in the history of aviation. Neither should they affect our view of aeronautics. This is no occasion for condemning the airship as a type, or condemning flying as too dangerous for humanity.

The principles of lighter-than-air craft and of flying in general are sound. The ultimate rewards offered by mastery of the air will continue to urge us on toward such a mastery. The accident is our penalty for ignorance, and it will not keep us from pushing on toward knowledge. The world, whatever it says at the moment of its grief, understands this pretty well. It can do no more for its dead than give them honor and redouble its effort to reduce the penalty for progress which the world has always paid and will probably continue to pay for many to-morrows.

Air Laws

SEVERAL committees of the American Bar Association are working at Cincinnati upon the drafts of acts looking to federal control of aircraft and aviation. It is promised that some action will be taken by the annual convention and that the recommendations of the convention will be pressed upon the attention of Congress.

This is the most promising talk heard as yet upon the question of air laws. The problem has been discussed in a general way. Cities and states have proposed a considerable local legislation, some of which has been put into effect. There has been no federal control. As the law of the United States stands at present anyone can buy whatever 'plane he wishes and use his own judgment as to flying it. If he is willing to risk his own life, that of his friends, or even the lives of hundreds of patrons, no one is authorized to forbid him.

This condition of affairs has persisted during a period of considerable aerial development. Air routes have been established—every night a passenger-carrying flying boat comes from Atlantic City and fares up the North River—demonstration flights are common, and there are a number of individuals and clubs owning and flying machines.

Canada has regulated air traffic within her borders. We in the meantime sit by while the 1917 army 'planes wear out, taking their toll of human life in the moment of collapse. The chief voices raised in favor of regulation are, paradoxically, the voices of those who manufacture or operate aircraft. They are asking for the inspection of machines and for rules on flying altitude, stunts, paths of flight, and landing.

THE NEWS OF THE WEEK

Dinner to Gordon Bennett Pilots

The Aero Club of America gave a farewell dinner in the garden of the American Committee for Devastated France, adjoining the Club House, to The American Team who are going over to Belgium to compete in the International Gordon Bennett Balloon Cup Race to be held in Brussels, on September 18th, on Friday evening, August 26th.

The members of the American Team who have been selected to represent America are Ralph Upson, winner of the National Championship Balloon Race and his aide, C. G. Andrus of the United States Weather Bureau; The Akron Chamber of Commerce is sending Mr. Ward T. Van Orman, in charge of the Airship Construction Division of the Goodyear Tire and Rubber Co., with Mr. Willard B. Seiberling as his aide. Mr. Bernard Von Hoffman and Mr. J. S. McKibben as aide, represent St. Louis.

This classic of the air has been won four times by America and was captured by the representatives of Belgium in the International Balloon Race held last October from Birmingham, Alabama.

Representatives from America, England, France, Belgium, Italy, Spain and Switzerland, will compete in this race.

This handsome trophy was put up by Mr. James Gordon Bennett for International competition and is considered the championship sporting classic of the air.

The American Team has the best chance to win this year and has every confidence that they will bring back this handsome trophy to resume its place of honor in the trophy room of the Aero Club of America.

Urge Uniform Law For Aero Control

Passage of an amendment to the Federal Constitution as the proper basis for aviation control was recommended in a report by a special committee of the American Bar Association made public August 24.

The report challenges the proposition that it is an invasion of the rights of private ownership of property to utilize air for purposes of flight.

"It appears to be the unanimous judgment of those practically interested in the development of the art of flying," the report said, "that the demands of progress are for a uniform law operative throughout the country. If complete control is to be lodged in the National Government, the power should be conferred by constitutional amendment and should not be seized in the guise of the exercise of existing powers."

Kansas Air Meet

The First Educational Air Meet of Kansas will be held at Wichita, Kansas, on September 15, 16, 17.

This meet promises to be the biggest that has been held west of the Mississippi.

From the way the business men have responded to this event $5,000.00 will be available in cash prizes.

Already the entire list of entrants, who participated in the Colorado Aero Club's meet, have signified their intention of entering.

There will be events for all types of planes. Special effort is being made to have a number of high speed machines participate in the Aerial Derby.

All aviators desiring to enter, should address their entries to Air Meet Committee, Lassen Hotel, Wichita, Kansas.

The Concordia Meet

A three day aviation tourney in which fourteen aeroplanes participated was held at Concordia, Kan., August 11, 12 and 13. It was the first aeroplane meet in Northwestern Kansas and attracted aviators from Kansas, Colorado, Nebraska and Iowa. Twelve cups were given.

J. Hodgens Smith of Grand Island, Nebr., who has been a consistent winner in middle Western meets won a cup for acrobatics. The cup for cross country racing and spot landing was won by Errett Williams of Arkansas City, Kan., with his JN4D. Pat McCarthy, d-airdevil, won a cup for plane shifting and other stunts.

A feature of the meet was the first demonstration of a Kansas made commuters' plane made by the Longren Aircraft Corporation of Topeka. The plane has fold back wings permitting use of a motor garage as a hangar. It has a radial Anzani motor. The ship won the altitude contest.

The three day aviation tourney was attended by 15,000 from Kansas and Nebraska. A school of aeronautics was held in connections with the show. There were no accidents during the three days of stunt flying.

The Late Monte Rolfe

Monte Rolfe, one of the best known pilots in the United States, was killed in an aeroplane accident at Havana, Cuba on August 15. No details of the accident are available. Rolfe was born in England, whre he learned to fly. He had been in the United States since 1917, and had a very wide circle of friends. He was a skillful pilot, with an excellent record, and his death is a distinct loss to American aviation.

Washington Service to be Started

The Seaboard Consolidated Airlines of New York City announced August 22 the purchase of six Fokker limousine aeroplanes to be put in immediate service between New York and Washington. Each plane will carry six passengers and 1,000 pounds of baggage on a trip.

Officials of the line inspected one of the planes and made a flight over the city. The party consisted of Stanley Hubbard, President; Roy Pendleton, Secretary, and Homer C. Babcock and Charles M. Wilson, Directors. The initial flight of the new daily service, they said, would be made this week.

The Netherlands Aircraft Company, which manufactures the Fokker planes, announced that the six-passenger Half Moon would undertake to fly to Mexico City in three "hops," the stops being Chicago, Kansas City and El Paso.

National Guard Air Unit Almost Ready

The First National Guard Air Service Squadron in the United States is practically ready to start flying operations at Nashville, Tenn., according to information received by *The New York Times* in a statement from the commanding officer, Major John Caldwell Bennett, Jr. The project has been under way several months.

Interest in it was awakened in the Militia Bureau at Washington by the large possibilities of keeping alive the backbone of a National air service by organization of National Guard units, and in the War Department by the prospect of finding a ready and practical use for the huge surplus supplies of the air service.

The Nashville organization is designated in official records as the First Observation Squadron, Air Service, Tennessee National Guard. Headed by Major Bennett, who was a flight commander in the 139th Squadron, Second Pursuit Group, with headquarters at Souilly, France, during the war, the personnel of the squadron includes several officers, both pilots and observers, who saw service overseas, and officers who were flying instructors in the United States. The enlisted personnel also includes mechanics with actual Air Service experience.

After the preliminary organization had been perfected through an enlistment campaign, an inspection of the personnel was made last January by Major Henry V. Claggett, U. S. A., looking to Federal recognition of the unit so that equipment could be issued by the War Department. His report was understood to have been favorable, but recognition was held up for several months while the State and the War Department settled which should provide hangar facilities.

Provision for National Guard air service was made in a War Department circular letter in June, 1920. The letter specified that the State should provide landing field and hangar facilities and enlist the personnel, which the War Department would furnish all flying equipment. A field was leased by the State for six years, but "Uncle Alf" Taylor, Tennessee's Governor, balked at the hangars.

The problem was finally solved by the donation to the squadron of sufficient funds by the Commercial Club of Nashville to enable it to purchase hangar facilities. Then, says Major Bennett:

"Washington wired us that they would give us two hangars from Park Field, Memphis, but that we would have to pay to have them torn down and shipped to Nashville. We immediately accepted this offer and asked for shipping instructions. Last week I sent Lieutenant Charles G. Pearcy, our squadron adjutant, to Memphis to superintend the removal of the hangars. They will be standing on our field by the end of this week."

Meanwhile the personnel of the squadron had begun to lose interest and attendance at the ground school dropped off heavily. Letters were sent but did no good.

"Three weeks ago when we called the roll," said Major Bennett, "I told the men they had to be present from then on and I discharged every enlisted man who was absent that night. We had thirty-nine present and I discharged forty-two. Then we started a new enlistment campaign and brought our number up to sixty. Later I discharged one Captain, two First Lieutenants and five Second Lieutenants for non-attendance."

The provisional basis on which the Tennessee squadron is organized was outlined by the War Department to include eighty-one enlisted men, most of them non-commissioned officers, and twenty-two officers, including a medical officer. Ten service aeroplanes will be issued to the squadron by the War Department, together with machine shop transportation and all other equipment.

To the squadron will be attached, for instruction and observation purposes, two officers and twelve enlisted men from the regular army Air Service.

War Department authorities are looking to the success of the Tennessee experiment to encourage organization of similar units all over the country. At present only one squadron to each army corps area is authorized, but if the movement should succeed it is probable that more would be authorized.

Steps have been taken in New York looking to the establishment of a National Guard squadron here, and Major Gen. John F. O'Ryan, in command of the New York National Guard, has kept in touch with the Tennessee unit's progress. So far, however, no definite arrangement has been made.

The Late Peter Cooper Hewitt

Peter Cooper Hewitt, the noted inventor, who was associated with the late Professor Francis B. Croker in his helicopter experiments, died in Paris August 25 as the result of an attack of pneumonia, following an operation.

N. Y.-Pacific Air Service Plans Not To Be Delayed

The plans for the commercial airway transportation service between this city and San Francisco, which is to be inaugurated in 1923 with gigantic airships, will not be delayed in any way by the ZR-2 disaster, it is authoritatively stated.

This service is backed by a group of capitalists of New York, Chicago, San Francisco and other cities, who have been in constant communication with the air service branches of the government. The initial capital involves $50,000,000.

The statement that the project would be pushed without delay was made by Fred S. Hardesty and Edward Schildhauer, the engineers representing the capitalists. They issued it in the offices of the Manufacturers' Aircraft Association, at 501 Fifth Avenue.

The airships to be placed in this service in 1923 will be built in this country, but will be fabricated from German duralumin. They will be approximately 30 per cent larger than the ZR-2, and will have a capacity of 200 passengers, besides crew and 50 000 pounds of freight.

According to the two engineers, they will make the flight from New York to Chicago in ten hours, and from coast to coast in less than thirty-six hours.

Dallas Aerial Police

New York is not the only city that can boast of an aerial police auxiliary. For Dallas, Texas, now has a trained group of flyers, holding special police commissions, who stand in readiness at all times to assist the regular force in emergencies, where the speed of an aeroplane or its reconnoitering abilities are needed. All are volunteers.

Two of Dallas' "flying cops" were in Houston recently, having flown over on business, though not the "official" variety this article might indicate. One was Captain S. C. Coon of the Curtiss Aeroplane Company, and the other was H. M. McGraw, a commercial aviator who operates Viaduct Field. Both are keenly interested in the new aerial police corps and Captain Coon made arrangements for getting some wireless telephone equipment from the government.

"An aerial police auxiliary," Captain Coon stated, "is invaluable in time of strikes or riots and can be used to good advantage in reaching scenes of disasters and directing relief work. Aviation has become so general that the skies must be patrolled as well as the land. Our corps has been aiding materially in checking hazardous flying of all kinds over Dallas, such as 'stunting' at low altitudes and skimming the tops of buildings, thus reducing the element of danger to residents."

Aerial patrols, he said, would be of great value in dealing with auto banditry such as Dallas experienced during the recent "crime wave." Given the general direction in which the bandits fled, Captain Coon stated that a patrol of planes could soon determine whether or not they left the city, if not actually locate the fleeing car and report its location by wireless telephone. In either case, the information would be of great help to the police.

Captain Coon and Mr. McGraw left Dallas early in the afternoon and were in Houston in time for supper. With the wind at their backs, they expected to make the return trip in less than four hours and theirs was not a speedy "ship" as planes go!

Viaduct Field, which is operated by Mr. McGraw, is in the heart of Dallas, being located only half a mile from the Adolphus Hotel. It is one of the largest in Dallas and besides the usual passenger carrying and aerial photographic work, Mr. McGraw also conducts a school of flying.

Personal Par

Capt. Maurice A. Mott, the owner of the Compañia Nacional Aeronautica of Lima, Peru, the first commercial aviation company in that country, is again in the game, having made a number of interesting flights in both the S V A and the Curtiss Oriole. Capt. Mott had the misfortune of having his leg broken last August, being hit with the propeller, breaking the bone just above the knee in seven pieces.

Thurston Developing Cotton Fabric

Captain W. Harris Thurston, who was in charge of specifications, inspection and production of balloon and aircraft fabrics during the war, has returned to civil life as president of the W. Harris Thurston & Co., Inc., 116 Franklin Street, New York. This firm, in addition to the converting and commission merchandising of cotton fabrics, will make a specialty of mechanical cloths. Among the latter aeronautical fabrics will be a feature as Mr. Thurston intends to further develop this material. That he is well qualified in this capacity is recognized by all the large users of fabrics in this country as it was due to his untiring energy to a large extent that the present satisfactory cotton aeroplane cloth was developed. His experiments extended over a period of some ten years when linen was thought to be the only material that could ever meet the requirements of aeronautical cloth.

Canadian Notes

Halifax, N. S.—Travelling part of the way at a rate of over 100 miles an hour, the gigantic Canadian hydroplane, piloted by Colonel Robert O. Leckie, from Ottawa to Halifax, made the last leg of its journey from Fredericton, N. B., to the air station in two hours and a half. The whole flying time of the trip of eight hundred and forty miles from Ottawa to Halifax was approximately nine hours and forty-five minutes. It was a most successful and uneventful air voyage, according to the passengers who accompanied the colonel. These were: Col. J. S. Scott, O. C., Canadian Air Forces; Flight-Lieut. Walter R. Kenny, Flight-Officer E. R. Owen, and Warrant Officer W. C. Chapman.

The largest seaplane in Canada has been brought to Halifax to take part in the combined naval, military and air maneuvers next week.

A serious mishap in landing at Peace River occurred when a monoplane of the Imperial Oil Co. attemped to alight on the stream after completing a 1,100-mile flight from Simpson. No injuries were suffered by the crew or passengers, but the machine was badly wrecked and is almost completely submerged.

Captain Geo. W. Gorman with Mechanic W. J. Hill sitting with him and two passengers, Chester A. Bloom and Walter Johnson, were in the machine when the surface was struck. Instantly a rock on a hidden sand bar wrenched the right pontoon clear of the machine, and the impetus of the 90-mile-an-hour landing speed twirled the machine around and crumpled the left wing.

Roma Being Erected

The Roma, which recently arrived at Norfolk, is now being erected at Langley Field. The Roma is 416 feet in length and has a diameter of 82 feet. Her maximum speed is rated at 70 miles per hour, and she has a cruising radius of 1000 miles.

Night Flying Proves A Big Attraction

That air forces can destroy sea craft by night as easily as by day is the claim which the Provisional Air Brigade expects to establish as a fact in bombing exercises scheduled to take place some time in September. The U. S. S. Alabama has been designated as the target for the project.

Preparatory to the coming tests, the big work now being conducted by the Brigade is the training of bombing pilots in night flying. With the exception of Thursdays, Saturdays and Sundays, flying activities are carried on every night at Langley Field.

Regulations established by Brigade Headquarters for night flying are based on the general rules observed in daylight flying with special provisions to be observed in connection with problems encountered at night. A system of signals has been formulated whereby planes are directed to land and to take off, while code numbers assigned previous to the flight are used to identify the planes.

Distinguished Visitors Inspect Langley Field

Captain Katsuzo Kosuda, Inspector of the Ordnance Depot of the Imperial Japanese Army and Professor T. Tamjaru, who is the professor of Physics and member of the Aeronautical Research Institute of the Imperial University of Tokyo, Japan, were visitors at Langley Field last week.

Airship C-2 Makes Trip to Camp Meade

The C-2, which left for Camp Meade where it was engaged in daily flights and exhibitions before the Reserve Officers' Training Camp being conducted there, returned to Langley Field last week. Majors Fisher and Peek and Lts. Parris, Thompson and Holland, were included in the number making the trip.

A large number of Reserve Officers were taken on flights, over a hundred having requested this privilege, while the visit of the dirigible was made especially interesting for the camp when two of the airship's officers made parachute jumps from the big ship. Lts. Anderson and Thompson volunteered for this service, both men making excellent jumps before the large crowd of spectators.

The AIRCRAFT TRADE REVIEW

Wadsworth Introduces Federal Control Bill

Washington.—A bill for the governmental control and development of civil aviation was introduced August 24th by Senator Wadsworth. In explaining what it is proposed to accomplish by his measure, the Senator said:

"This bill provides for the control, regulation and development of civil aviation. In line with the recommendations made by President Harding in his inaugural message, it establishes a bureau of aeronautics in the Department of Commerce, thus providing commercial flying with a centralization already possessed by the Air Services of the army and navy.

"Through control, regulation and development civil aviation can make a real contribution to our transportation needs, and particularly in the carriage of mail, and at the same time provide an economical and indispensible reserve for the military and naval services.

"Already 1,200 commercial aircraft are in operation, but due to the lack of Federal control there were forty serious accidents in civil aviation the first six months of the year in which fourteen persons were killed and fifty-two injured.

"Of equal importance with the inspection and laying out of air routes is the establishment of terminals and the provision of means for disseminating weather reports and operating signals for aviators—all provided by this bill.

"This bill is also designed to correct a curious and extraordinary situation that is developing in customs and quarantine. Smuggling of persons and goods—including liquor—is easier by air than by many other methods, and contraband flying cannot be controlled except by special law with all the force of the Government behind it.

"This bill was prepared in response to the urgent solicitation of a score of organizations throughout the United States representing the operating, engineering, constructing, commercial and sporting elements in aviation. Its early enactment is imperative as a means of saving life and property, aiding our economic development and strengthening our national defense."

Parker Aircraft Company

The Parker Aircraft Co. has established headquarters at Perry, Iowa, where they have prepared a sales organization for Curtiss and Canuck parts.

The company has leased a substantial building and have complete facilities for rapid and careful work.

Diggins School News

Up to the end of August the Ralph C. Diggins Aviation School had graduated 65 pilots for the present season.

De Senn Chung, who graduated from the school last November, is now a major and chief instructor in the Chinese Air Service at Peking, China. He comments enthusiastically on the excellent training that he received at Chicago.

Chief instructor James Curran made over 2600 flights during the month of July, giving instructions and doing commercial work, rolling up a total of 216 hours flying time for this period.

Personal Paragraph

B. M. Spencer, formerly chief engineer of the Friesley Aircraft Corp., of Gridley, Cal., has severed his connection with that organization and expects shortly to associate himself with another California company.

New System of Determining Ground Speed of an Aeroplane in Flight

A mathematical system for determining the ground speed of an aeroplane during flight, as well as wind direction and velocity at any altitude, which shows considerable promise of proving an interesting and highly useful solution of these heretofore difficult problems in the longer cross-country, photographic, and bombing operations, has recently been evolved by Major Junius W. Jones, A. S., who has just completed a series of tests in these subjects incidental to his routine air missions as a student pilot at the Air Service Observation School, Post Field.

The system devolves upon the known geometric relationship between three factors, all of which may be readily determined by the pilot whilst in flight; namely, air speed, drift angle, and time each way between any two nearby points on the ground. An exact mathematical height above the earth, independent of the data given at the moment by the aneroid instrument, may also be determined by the system worked out by Major Jones, and would doubtless prove of great advantage over the altimeter, which is necessarily limited in accuracy by zero orientation at the home landing field, in cases where exact scale photography were to be carried out over distant objectives of varying elevation above the sea level, or when, in artillery work, the Battery Commander is requested to lay his guns on the plane, the exact altitude of the ship above the designated target forming the base line of triangulation by which accurate range may be determined.

To reduce the application of his system to a practical basis so that the pilot's attention need not be absorbed in calculation, which the inventor modestly admits must lead to realms somewhat abstruse before the integrations employed may be directly applied, Major Jones has resolved all formulae into a single simple chart, consisting of a series of arcs with their intersecting and correlated curves, a photostat copy of which has already been published in practical scale for use in the cockpit. By this chart it is necessary only for the pilot to adapt the simple arithmetical factors of time, airspeed and drift angle to a base line of the chart, which is then followed through its various intersections graphically to obtain the desired information concerning ground speed, wind direction and velocity, compass course, or altitude, etc.

Air Service Bids

Fire Box Heating Boiler—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 2, circular 2237, for furnishing 1 fire box heating boiler with down craft furnace, size sufficient to supply 10,000 feet radiation, 50 pounds working pressure. For information address above.

Pistons—Engineering Division. Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 9, circular 2238, for furnishing 150 pistons with oil relief groove. For information address the purchasing and contracting officer.

Engine Parts—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until September 9, circular 2234, for furnishing miscellaneous parts for engine model W-2 as follows: 2 crank shaft bearings, 2 magneto drive gear bearing spacers, 2 oil thrower crank shafts, 2 tachometer drive shaft bearing spacers, 2 oil and water pump drive bearing spacers, 12 cam shaft drive shaft housing lower connections, 12 cam shaft drive shaft lower upper bearing cage, 2 magneto drive red gear shaft collar, 2 fuel pump driven shaft gears, 2 magneto spark control shaft bearing container nut pins, 2 fuel pump drive shafts, 2 magneto spark control shaft bearing containers, 8 magneto drive shaft bearing housings, 2 crank shaft gear bearing retainers, 2 crank shaft gear bearing retainer covers and 2 crank shaft gear centering sleeves. For information address above.

Engine Parts—Engineering Division, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 6, circular 2233, for furnishing parts for model W-2 engine, including 5 oil pressure line fittings, 5 do., 120-cylinder to crank case, clamp-nut lock washers, 120-cylinder to crank case clamp nuts, 120-cylinder to crank case nut lock washers, 120-cylinder to crank case nuts, 15-cylinder water inlet elbows, 75-cylinder water outlet connections, 8-cylinder water inlet tees and 100-cylinder water outlet cover plates. For information address the purchasing and contracting officer.

Cylinder Heads—Engineering Division, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 9, circular 2236, for furnishing 3 cylinder heads. For information address R. H. Fleet, purchasing and contracting officer.

Engine Parts—Engineering Division, Air Service, Dayton, Ohio.—Bids are wanted until 10 a. m. September 9, circular 2235, for furnishing parts for model W-2 engine, including 2 generator gear washers, 2 crankshaft gear nuts, 2 crank gear bearing retainers, 2 crank shaft thrust bearing nut screws, 12 cam shaft drive shaft upper nuts, 4 cam shaft drive shaft lower center nuts, 3 oil and water pump drive shaft nuts, 8 cam shaft bearing dowel shorts, 12 cam shaft drive shaft upper nut lock washers, 2 tachometer drive gear key washers, 2 magneto drive gear nuts, 8 cam shaft drive shaft lower nuts, 2 magneto spark control shaft bearing container nuts, 2 magneto spark control shaft collars, 2 magneto drive internal gear nuts and 2 fuel pump drive shaft collars. For information address R. H. Fleet, purchasing and contracting officer.

THE ZR-2 DISASTER

THE tragedy of the destruction of the ZR-2 in England occurred when hopes were highest that the great dirigible had at last satisfied all tests required before the ship was to be turned over to the United States Government. She had been out for thirty hours cruising in the North Sea and off shore, and her wireless told a story of good control and soundness of fabric. The ZR-2 was, in fact, about to come down to her shed when she was seen literally to contract and break asunder. There was a tremendous explosion of her tanks. The gigantic steel frame was wrecked, parts of it blown to fragments. Even after what remained of her fell into the Humber, the flames and smoke that rose into the air frustrated attempts to rescue any of her officers and crew who were alive.

As in all great tragedies of the sea and the air, there was in the loss of the ZR-2 a thrilling and outstanding display of heroism. The airship caught fire when she was directly over the center of this populous little city and while the entire population, with eyes strained upward, stood admiring her. Had she fallen in the city, the havoc there would have been horrible.

But Commander Wann, with the great airship cracking in two and with the flames creeping ever nearer the fourteen great bags filled with hydrogen gas, opened wide the throttles of the six great engines of the dirigible and hurled the crippled monster in the River Humber shallows, a scant 200 yards from the pier line.

Imprisoned in a burning gauzy bird cage a mile in the air and which in a few seconds was transformed into a veritable hell, the men aboard the airship had little chance to escape. Those who did escape leaped through the traps in the main floor of the car and by the use of parachutes, which were attached to each airman's shoulders, landed safely.

The heroic conduct of the commander is held here to be beyond all praise. When he was faced with the catastrophe he bravely steered the burning ship toward the river. If he had wavered or lost his presence of mind it would have descended on the old town and probably have practically laid it in ruins. Commander Wann accomplished a magnificent deed.

The tide rose rapidly after the fall of the airship and at dark every part of it was submerged.

The wreck of the ZR-2 was a terrifying scene. About 5:30 o'clock in the afternoon the airship, flying about 1,000 feet up, was first seen. She was sailing gracefully over the west central district of the city. The sky was beautiful and there was scarcely a vestige of a breeze. She was seen to shake and then her nose dipped. A puff of smoke arose from her bow. This was followed by a spurt of flame. Thousands looked aghast at the sight in the sky. Cries were heard:

"She has cut in two!"

This was true, but what had caused it it was impossible to imagine. A heavy mist seemed to hang about her. In fact, the atmosphere immediately became so hazy that the fire aboard the giant of the air was not the striking note of the spectacle.

Then six columns of smoke poured from the ship.

Women screamed. Both men and women rushed to shelter, behaving just as they did during Zeppelin raids on Hull in the world war.

It seemed that just before the explosion aboard the ZR-2 she turned in a southerly direction. No doubt the captain of the airship, realizing the danger, turned toward the Humber.

The Navy Department announced that official word had been received that six officers and eleven of the men of the non-commissioned personnel of the navy were on board the ZR-2 when the disaster took place.

The department gave out this list of officers figuring in the accident, with names of next of kin:

Officers

Commander Louis H. Maxfield, brother, A. C. Maxfield, 627 Goodrich Avenue, St. Paul, Minn.
Lieut. Commander Valentine N. Bieg, mother, Mrs. F. G. Bieg, 120 South Fairfax Street, Alexandria, Va.; wife, care of Mrs. Ronald Barlow, Haverford, Pa.
Lieut. Commander Emery Coil; wife was with him in England.
Lieutenant Charles G. Little, father, Henry B. Little, 227 High Street, Newburyport, Mass; body recovered.
Lieutenant Marcus H. Esterly, wife M. E. Esterly, 242 Auburndale Avenue, Youngstown, Ohio; body recovered.
Lieutenant Henry W. Hoyt, mother, Mrs. R. D. Hoyt, Clearwater, Fla.

Non-Commissioned

Charles I. Aller, father, H. L. Aller, 1200 Thirteenth Street, Denver, Col.
Maurice Lay, wife, Mabel R., 400 Eugent Street, Greensboro, N. C.
A. S. Pettit. wife, Margaret H., 326 East Thirty-fifth Street, New York.
Robert M. Coons, mother, Kate, 812 Allen Street, Owensboro, Ky.
Lloyd E. Crowel, wife, Minnie, 26 Savage Street, Charleston, S. C.
J. T. Hancock, father, John, 17 Godwin Road, London, England.
William Julius, mother, Frieda J., 356 Seventy-seventh Street, Los Angeles, Cal.
Albert L. Loftin, father, James Benjamin, 710 Shattuck Street, Lake Charles, La.
William J. Steele, wife, Lena C., Bainbridge, Ind.
George Welch, sister, Elizabeth Kimmerman, 159 Valley Road, Montclair, N. J.

Five Millions Invested

When the blazing wreck of the ZR-2 dropped out of the air there was lost not only the biggest airship in the world and nearly all of her experienced crew, but an investment of about $5,000,000. There will be saved for future use the immense hangar at Lakehurst, N. J., built especially for the ZR-2, and which cost $2,000,000, but the cost of the ship, for which the navy was to have paid $2,000,000, and the additional million spent for wages, transportation, trials and other expenses is a complete loss.

During her first trial trips, beginning on June 23, the ZR-2 developed a "hump." This was caused by the bending under strain of the supporting girders and latticework that kept the giant envelope in shape and held the understructure to it. Engine trouble also developed. On her first trip she remained aloft for forty-eight hours with forty-eight persons aboard, including Commander Maxfield.

Subjected to Severe Trials

With the strengthening of these girders and rods the tendency to buckle seemed to have disappeared. Nevertheless, the British builders refused to turn the airship over to the navy airmen until she had been subjected to severe trials, and even suggested a postponement of the day she was to start on the voyage to America, which was set for next Sunday.

The ZR-2, as the largest and latest experiment in aircraft building, represented all that was new in rigid dirigible balloons. The balloonettes, containing the hydrogen gas and filling the immense cigar-shaped envelope, were constructed after a new method that saved both money and material.

The British designed the ZR-2, or R-38 as she was named when planned, to be a dreadnought of the air, and the most formidable craft cruising between earth and sky. She was designed for a flight of 5,000 miles at her full speed of seventy miles an hour, or for 6.500 miles at a speed of ten miles an hour slower.

With her length of 695 feet, fifty feet over the R-34, the ZR-2, could she have been set on her nose and leaned against the Woolworth Tower, would have reached almost as far up as the gilded cupola. Her diameter was eighty-five feet. The innumerable balloonettes held 2,700,000 cubic feet of hydrogen gas, capable of lifting eighty-three tons of deadweight.

Fourteen Machine Guns Carried

The armament which this great airship carried suggests the bristling guns of a battleship. The specifications called for fourteen Lewis machine guns, and a one-pounder automatic. Her torpedo equipment called for four bombs weighting 520 pounds each, and eight bombs weighing 230 pounds each. The guns and bombs, placed at all of the vantage points from stem to stern, could be turned on attackers from land, sea or the surrounding air.

The lessons learned from the fate of the Zeppelins during the war were remembered in designing the ZR-2. To guard against the puncturing of her gasoline tanks by locating an unprotected spot and holding back the trigger of a machine gun until the stream of bullets found their mark, the ZR-2 had machine gun nests at the tip of her stern, one out toward her nose, and one in each of the four cars carrying the engines.

The one-pounder automatic was in a cockpit on top of the big envelope.

Four gondola cars hung from the envelope. Extending the length of the ship was a passage way bounded on both sides by a network of girders, guys, wires, gasoline and water tanks, valves, pipes and tubes in a confusion and conglomerate profusion that made a layman dizzy. Concentrated in the pilot house, within reach of the captain's hands, was the collected array of electric buttons, levers and switches by which the ship was operated.

Standing at his instrument board, the commanding officer would have been able to steer the ship to the right or left, or upward or downward, to drop a bomb, to release gas from any part of the envelope, to empty tanks of water ballast, to keep himself informed of the workings of the ship from end to end, to signal any one of the engines, send a wireless message or control gunfire. A telephone system connected all parts of the craft.

Sleeping Quarters for Thirty

Sleeping quarters were provided for thirty officers and men, and food was heated by the exhaust from the engines passing through a special apparatus.

She was designed to take on supplies through pipes, so that by tying up to a mooring mast and connecting with the fuel supplies her tanks of gasoline, oil and water could be quickly filled and flight resumed.

The measurements of the ZR-2 were: Length, 695 feet; diameter, 85 feet 4 inches; capacity 2,700,000 cubic feet; lifting capacity, 83 tons; disposable lift, available for fuel, stores and other purposes, 50 tons; engines, six of 350 horsepower each, total 2,100 horsepower; endurance, 6,000 miles; maximum altitude possible, 25,000 feet. The ZR-2's nearest competitor was the R-34, that made the trip from England to America and back in 1919.

Huge Hangar Prepared

Awaiting the ZR-2 over here was a hangar of the same record-breaking proportions as herself, and 250 officers and men to take charge when she landed at Lakehurst.

Had the weather been fair the airship would have been moored to a steel harness attached to three big concrete blocks, laid out in a triangle. Fastened at the nose, the ZR-2 would have been able to float above the ground and meet wind from any direction. A steel mooring mast was under construction.

The hangar, intended for use in bad weather, is equipped with sliding doors so big that it takes the operating machinery ten, to fifteen minutes to open them. A three-track railway runs through the hangar and out into the field for 1,500 feet at each end. Placed on a train of flatcars and secured with tackle, the ship would have been rolled under cover for protection.

With the gradual reduction in the time of crossing the Atlantic by the ships of sail and steam that followed Columbus for five hundred years, the most astonishing, coming within a few years, is that made by aircraft.

The ZR-2, in time of war, would have been equal to several scout cruisers. Her gas bags, filled with helium gas, would have been in no danger from fire. Helium is non-inflammable and almost as buoyant as hydrogen. The navy has a plant at Ft. Worth, Tex., where helium is extracted from the natural gas, the only plant of its kind in the country. It is in daily operation. There is now wasted at natural gas plants 100,000 cubic feet of helium that the navy could use in time of war.

Unlike the R-34, which crossed in 108 hours, 12 minutes, in July, 1919, the ZR-2 would not have had to nurse her fuel supply. She carried 2,900 gallons of gasoline more than did the R-34 and was capable of from ten to twenty-five miles an hour greater speed. She had six 350-horsepower motors, compared to the R-34's five of 250-horsepower.

The course plotted for the ZR-2 was from Howden, westward over Ireland and then west by south around the curve of a great circle to Newfoundland. She was then to cross New England and New York to Lakehurst.

ZR-2 Out of Date

A despatch from the Washington correspondent of the New York *World*, states: The ill-fated airship R-38 which carried to their deaths practically the whole American and British crew on its trial trip was of obsolete type and had structural weaknesses to which our flying men attribute the disaster.

Extraordinary as it may seem, these defects were known to both army and navy aviation men and formed the basis of adverse reports on file in the departments.

In the testimony there are passages that show the British knew the faults of the design as well as ourselves. The only explanation of the navy's ordering the airship in these circumstances was that it needed such a ship, and the R-38 was available.

Was Like 1914 Zeppelin

Denuded of the specification technicalities, the R-38 was merely a 1914 Zeppelin, into the middle of which had been sandwiched an extra section to make it longer. There were other defects which were pointed out by the American officer who inspected her in July, 1919, when the frames were being assembled and the making of the gondolas was practically complete.

"So," runs this officer's report, "the design can be said to be that of a 1914 Zeppelin, with increased lift obtained by the insertion of parallel sections in the design of previous ships."

This report was made while the ship was building. Accounts of the catastrophe agree that the R-38 broke in two amidships—just where the extra section was inserted in the design after the 1914 Zeppelin.

"This ship," the report continues, "is now obsolete for several reasons.

"Her basic design was patterned after an obsolete Zeppelin type. Another feature which in itself should have relegated the R-38 to the scrap heap was that her stabilizing surfaces were planned to be externally braced. All approved practice in the modern building of such ships requires internally braced fin surfaces built as an integral part of the ship.

"The aircraft section of the Allied Naval Commission, which visited the different air stations in Germany in December, 1918, commented on this phase in their confidential report, with which English and American naval officers are familiar. A modern ship would under no circumstances be built without internally braced fins for the reason that they do away with external bracing wires, which increase resistance and lessen speed.

"Internal construction strengthens both the fins and the hull, increasing safety thereby. They increase the manoeuvering power greatly. They tend to hold the ship to its course more truly. They permit passage inside the fins to the control surfaces, thus permitting repair or adjustment during flight."

Was Obsolete, Navy Knew

In another portion of the testimony one of the navy aviation authorities is quoted as stating that the navy realized the airship R-38 was obsolete when it bought the craft.

It is worth adding that Brig. Gen. Edward Maitland, who commanded the R-34 on her trip to America, was killed in the explosion of the British ship's sister craft, said when he had completed the first lighter-than-air transatlantic flight that the R-34 even then was "virtually obsolete."

The R-38 was designed and construction on her was started during the war—work on her was under way when the navy bargained for her.

The first English ships of the Zeppelin type, the R-33 and the R-34, were patterned after the Zeppelin L-33, brought down near Colchester, England, in 1916, and the Zeppelin L-49, brought down in France the same year. The first British ships, R-33 and R-34, were not completed until after the armistice. One expert, who had devoted years to studying the technical side of lighter-than-air craft, says:

"Without practical experience in rigid powers and limitations, the English went on producing larger ships by simply inserting parallel sections, which gave a greater lift only at the cost of considerable loss of speed."

Structural Defect, States Wann

Lieutenant A. A. Wann, who was in command of the American navy dirigible ZR-2 when it collapsed in mid-air Wednesday above Hull and plunged into the Humber River, with the loss of forty-four lives, said in a signed statement that the structural weakness of the ship had caused the disaster.

This declaration was made to the Hull police in connection with the official inquiry into the tragedy at the airdrome at Howden. As reported by the Hull correspondent of *The London Star* this evening, Wann's statement reads:

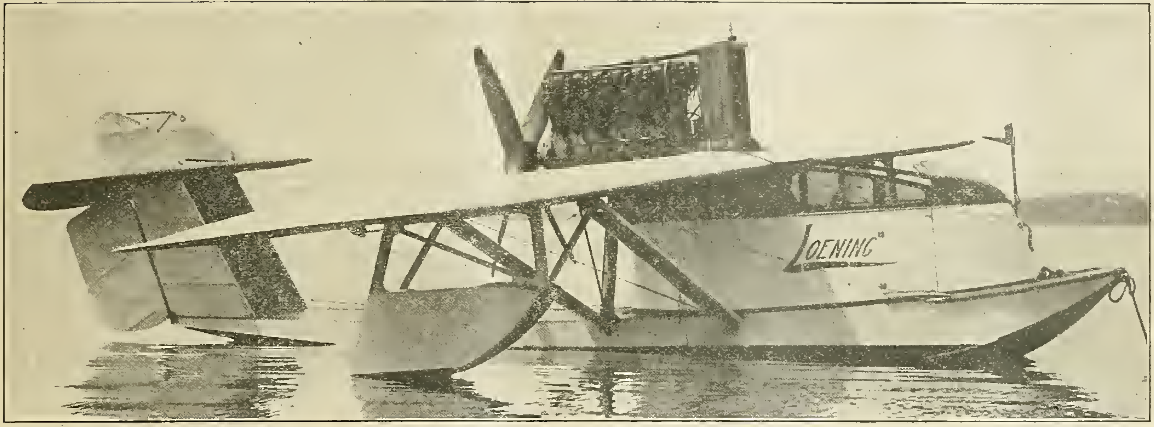
"I want to say that the accident was due to a weak structural part of the ship which broke in two pieces. I couldn't say which part it was. I had been flying for 36 hours when the mishap occurred and had intended to make this my last flight."

The Star correspondent says that Lieutenant Wann sent word to the police that he desired to make a statement regarding the disaster. Inspector Dont, accompanied by a constable, went to the hospital where Wann is, and took down the statement, which the flyer signed.

The fact that Lieutenant Wann was the only person in the front part of the balloon who survived—the other four who lived through the accident were in the stern—makes his testimony regarding the cause of the airship's collapse of particular importance of the investigation. The explosions occurred in the forepart of the craft.

The strictest secrecy is being maintained regarding the investigation at Howden. Newspaper men who went to the airdrome were requested to leave. Sir John Salmond, Vice-Marshal of the Air Ministry, presided at the inquiry and Commander Horace T. Dyer, U. S. N., appointed by the American naval attache to represent the Navy Department, and several other United States naval officers, attended the hearing by invitation from the Air Ministry.

Every facility was given the Americans to make the inquiry as complete and searching as possible. The testimony of the airship's designers and others acquainted with the details of its structure is being heard.



THE LOENING MONOPLANE FLYING BOAT

WE illustrate herewith the Loening monoplane flying boat, which, as we reported last week, established a new altitude record for hydro-aeroplanes on August 16 by reaching a height of 19,500 feet with pilot and three passengers. An even greater height could easily have been reached had it not been for the discomfort of the passengers, who were garbed in summer clothing.

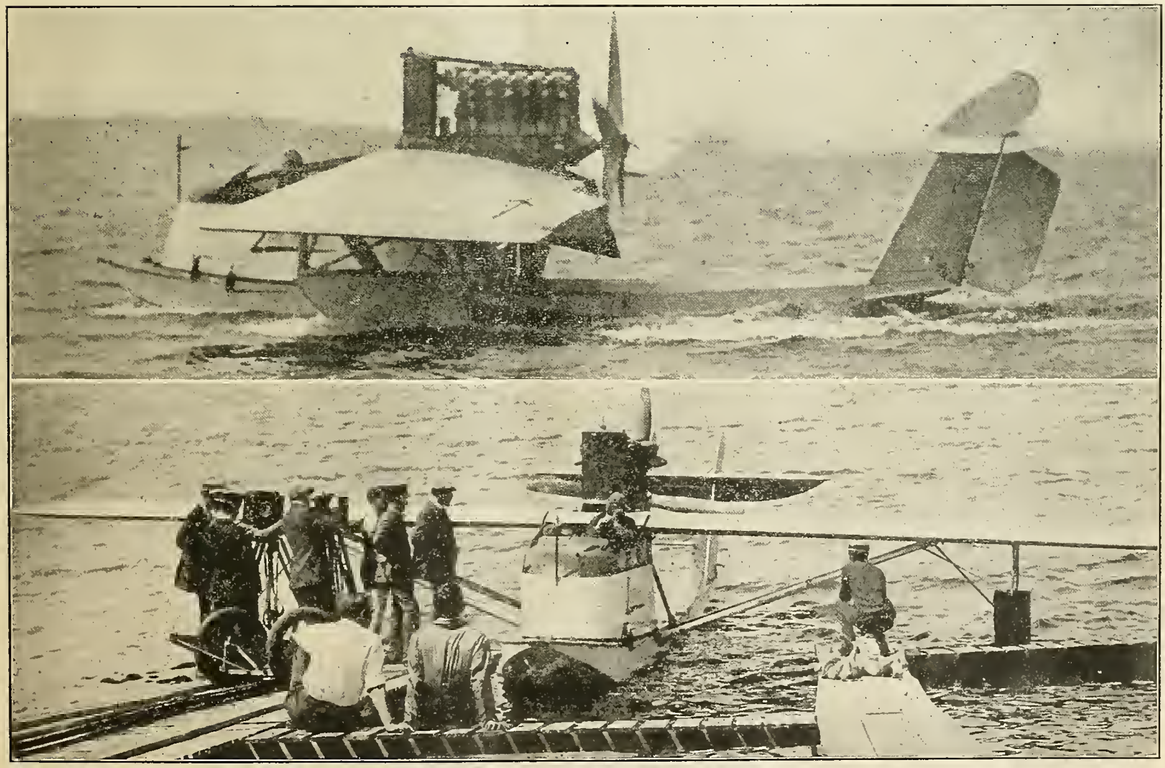
From the illustrations it will be noted that the machine has some new features. The passenger cabin is built on top, not in, the hull. The wings and wing strut bracings, it will be noted, are similar to those on the recent Loening monoplanes developed for the U. S. Army.

The wing span is 43 feet, and length of hull 25 feet.

The weight light is 2200 pounds; the weight loaded, which includes pilot, four passengers and two hours fuel, is 3500 pounds.

The power plant is a Liberty motor (high compression) equipped with Bijur electric starter. Its speed is between 125 and 130 miles per hour.

One of the remarkable features of the boat is that it is every bit as manoeuverable as a land machine. It has a very rapid climb and gets off the water with the motor turning up 1100 r.p.m. It flies with the motor throttled down to 900 r.p.m.



Two views of the Loening Monoplane Flying Boat which recently established an altitude record for three passengers and pilot

REPORT OF JOINT ARMY AND NAVY BOARD ON BOMBING AND ORDNANCE TESTS

1. The Secretary of War and the Secretary of the Navy have approved the following report of the Joint Board on result of aviation and ordnance tests held during June and July, 1921.

Nature of Experiments and the Results

2. Certain ex-German war vessels having been turned over to the United States Government in accordance with the decision of the Supreme Council as to their allocation, the Navy Department decided to comply with the provision requiring their destruction by conducting a series of experiments in which these vessels were to be sunk by gunfire or by bombs dropped from aircraft. In order that both branches of the national defense might gain the maximum benefit the Secretary of the Navy invited the Army to participate in these experiments.

3. In addition to the experiments with the ex-German vessels as targets, one was conducted with the ex-Iowa steaming under radio control as a hypothetical enemy. Search was conducted by aircraft and attacks made using dummy bombs from 4,000 feet altitude. This experiment was conducted with a view to obtaining information as to the effectiveness of aircraft in search operations, the ability of aircraft to concentrate for effective attack on a vessel at sea, and the percentage of hits which could be made by dropping bombs from this altitude under the most favorable conditions against a slow moving target capable of changing course at will to decrease the accuracy of bombing.

4. The aviation experiments were successfully conducted under the direction of the Commander in Chief, Atlantic Fleet, by the Air Force of the Atlantic Fleet and a provisional Air Brigade of the Army. The gunfire experiments were conducted by destroyers and battleships of the Atlantic Fleet.

5. The experiments extended over the period from June 21st to July 21st, and resulted in the sinking of the ex-German vessels as indicated below:

Type	*How Sunk*	*Date*
Submarine U-117	Bombs	21 June
Submarine U-140	Gunfire	22 June
Submarine UB-48	Gunfire	22 June
Destroyer G-102	Bombs	13 July
Destroyer S-132	Gunfire	15 July
Destroyer V-43	Gunfire	15 July
Light Cruiser "FRANKFURT"	Bombs	18 July
Battleship "OSTFRIESLAND"	Bombs	21 July

6. The schedule of experiments was so arranged as to obtain the greatest amount of information for the practical development of aviation and ordnance including weapons, their appurtenances, and projectiles. Boards of Observers were appointed by the War and Navy Departments.

7. The experiments definitely determined in each case that the projectiles used were superior to the defensive features of construction of the vessel attacked. It has long been recognized that the gun carried by any type of war vessel is superior at moderate ranges to the armor or protective construction of vessels of like type. In a large measure, therefore, the greatest interest in these experiments lay in the bombing of naval vessels by aircraft. The main features of this report, therefore, relate to the effectiveness of aircraft in offensive action against various types of naval vessels.

8. The Joint Board has carefully studied the reports of the Boards of Observers and as a result of such study, actual observation of the experiments by one or more members of The Joint Board, and general knowledge of the principles of war and methods of conducting war, has arrived at the following general conclusions:

General Conclusions

9. Within their radius of action, which, relative to that of naval vessels, is extremely short the effectiveness of heavier-than-air craft carrying large capacity high explosive bombs, depends upon:

(a) Ability to locate the naval vessel,
(b) Ability to hit the target vessel with the projectile carried,
(c) Ability of the projectile to damage or destroy the vessel.

Consideration of Ability to Locate the Naval Vessel

10. Aircraft of any of the three general classes: lighter-than-air ships, flying boats and land planes, either in combination or singly, have pronounced ability to search sea areas within their radii of action and to locate naval vessels operating in such areas. The high speed of aircraft and the range of visibility obtained by altitude are factors which make these craft especially valuable in the Service of Information.

11. Heavier-than-air craft may obtain the maximum radius of action for use in the Service of Information only by carrying additional fuel in place of heavy bombs. When armed with heavy bombs the radius of action of heavier-than-air types is inadequate for extensive search operations. Therefore, to conduct an effective attack on naval vessels it will usually be necessary to have certain aircraft for searching and others for conducting the attack with bombs.

12. Darkness, fog, falling or squally weather, will greatly reduce the effectiveness of aircraft in search operations. Most of these conditions likewise adversely affect surface vesssls conducting such operations but not to the same extent.

13. The present dependability of the personnel and material of the Army and Navy aircraft appears to be such as to ensure that search operations, under suitable conditions, can be conducted without an undue percentage of loss. The further development of aircraft will undoubtedly increase both dependability and radius of action.

Ability to Hit the Target Vessel With the Projectile Carried

14. The number of dummy bombs which actually hit the target during the experiment with the ex-IOWA was a very small percentage of those dropped. Other experiments, however, showed that it is not necessary to make direct hits on naval vessels to put them out of action or to sink them, provided the bombs drop sufficiently close to the vessel and the explosive charge is sufficiently large to produce a mine effect of such proportions as to destroy the water-tight integrity of the vessel beyond the control of its personnel and pumps. The effective target for the bomb being, therefore, greater than the deck area of the target vessel, the percentage of effective bombs would be greater than the percentage of actual hits.

15. Inasmuch as these experiments were not conducted under battle conditions it is difficult to draw conclusions as to the probability of hitting a target with bombs from aircraft while in action. Under the favorable conditions existing during the experiments—namely, stationary, or practically stationary, target, immunity from enemy interference and excellent visibility and flying conditions, the percentage of hits was greatly in excess of that to be expected under battle conditions.

16. The probability of hitting will be reduced in the case of a target moving at high speed on varying courses; further reduced if the target vessel is protected by effective anti-aircraft armament; and practically negligible if the target is protected by effective pursuit planes. On the other hand the probability of hitting will be increased by more efficient sighting and bomb-dropping control apparatus, by further training and further development of aerial tactics.

17. In the present state of anti-craft defense it is believed that, if an air force can obtain the mastery of the air, an effective percentage of hits can be obtained against surface vessels coming within the radius of action of bombing planes without an undue percentage of loss of aircraft. Anti-aircraft armament is in an early stage of development. The history of war indicates that means of defense develops rapidly to meet the development of offensive weapons. The effectiveness of the bomb carried by aircraft emphasizes the necessity for the rapid development of anti-aircraft armament and for the provision of pursuit planes as a part of the fleet.

Ability of Aircraft to Damage Naval Vessels

18. Aircraft carrying high-capacity, high-explosive bombs of sufficient size have adequate offensive power to sink or seriously damage any naval vessel at present constructed, provided such projectiles can be placed in the water close alongside the vessel. Furthermore, it will be difficult, if not impossible, to build any type of vessel of sufficient strength to withstand the destructive force that can be obtained with the largest bombs that aeroplanes may be able to carry from shore bases or sheltered harbors.

19. High-capacity, high-explosive bombs hitting the upper works of the vessel are disastrous to exposed personnel, serious to light upper works, comparatively slight to heavy fittings such as guns, and negligible to turrets. The effect of direct hits was completely local. The most serious effect of bombs is the mining effect when such bombs explode close alongside and below the surface of the water.

20. In the case of major ships the mining effect of a bomb will be materially reduced due to the ability of the personnel to free the ship of large quantities of water by means of

pumps to distribute the excess water through the various compartments and to shore up the water-tight doors and bulkheads which are in most serious danger of carrying away due to water pressure.

21. Aircraft, through the medium of machine guns and fragmentation bombs as well as by high-explosive bombs of high capacity, possesses sufficient offensive power to seriously threaten the exposed personnel of naval vessels unless such vessels are protected by pursuit planes. This emphasizes the necessity for the further protection of personnel and for the provision of aircraft carriers on which such pursuit planes may be based.

22. The effect of the gas bomb has not been determined but it is believed that such bombs possess offensive power which, within the radius of action of the aircraft, is today a serious threat to vessels insufficiently protected by aircraft.

Summary of General Conclusions

23. At present aircraft possesses the following abilities as regards operations with the fleet in areas beyond the radius of action of aircraft based on shore:

(a) Limited assistance to gunnery in the control of fire.

(b) Limited assistance in the Service of Information and Security.

(c) Important strategical and tactical qualities in operations of coast defense.

In adequate quantities they may be the decisive factor in such operations. The availability of these qualities at present depends largely on weather conditions. The radius of action of bombing planes limits their effectiveness against naval vessels to coast defense, or base defense, in which this type is a very powerful adjunct to the present system of coast defense.

24. With reference to the effect of aircraft on future naval construction The Joint Board is of the opinion that:

(a) The mission of the Navy is to control vital lines of transportation upon the sea. If no opposition is met from enemy naval vessels this mission can be accomplished without entering an enemy's coast zone within which aircraft based on shore or in sheltered harbors are effective.

(b) Without an effective Navy in time of war a nation must submit to an economic blockade fatal to its trade and the importation of necessary materials for the production of war supplies.

(c) If heavier-than-air craft are to be effective in naval warfare they must have greater mobility and since their radius of action is not great, additional mobility must be obtained by providing mobile bases—i.e., aircraft carriers.

(d) So far as known, no planes large enough to carry a bomb effective against a major ship have been flown from or landed on an aeroplane carrier at sea. It is probable, however, that future development will make such operations practicable.

(e) Even in the present state of development the aircraft carrier, as exemplified by the *Argus* of the British Navy, is a type essential to the highest efficiency of the fleet.

(f) Aircraft carriers are subject to attack by vessels carrying guns, torpedoes or bombs and will require, as all other types of vessels require, the eventual support of the battleship.

(g) The battleship is still the backbone of the fleet and the bulwark of the nation's sea defense, and will so remain so long as the safe navigation of the sea for probable, however, that future development will make in war.

(h) The aeroplane like the submarine, destroyer and mine, has added to the dangers to which battleships are exposed but has not made the battleship obsolete. The battleship still remains the greatest factor of naval strength.

(i) The development of aircraft instead of furnishing an economical instrument of war leading to the abolition of the battleship has but added to the complexity of naval warfare.

(j) The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy. They have proved also the necessity for aircraft carriers of the maximum size and speed to supply our fleet with the offensive and defensive power which aircraft provide, within their radius of action, as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed.

25. The Joint Board recommends that the provisions of the previous orders of the War and Navy Departments relative to secrecy concerning the results of the aviation and ordnance experiments be rescinded and that this report, if approved by the War and Navy Departments, be issued jointly to the press.

THE BARNHART TWIN NO. 15 "WAMPUS-KAT"

THE latest development in American, moderate sized, commercial transport aeroplanes is shown in the Barnhart Twin No. 15 "Wampus-Kat," a new product of the C. R. Little Aircraft Works of Pasadena, California.

Before the work of designing and constructing the machine was started, one year was spent in planning and investigating the need for a commercial aeroplane that would assist in establishing the commercial use of aircraft. Mr. G. Edw. Barnhart conducted this investigation and as a result incorporated into the design of Barnhart Twin No. 15, "Wampus-Kat," the features that would satisfy the needs of commercial aviation. Mr. L. G. Stern, who has over ten years' experience in aircraft construction, during which time he has held many responsible positions, is the shop superintendent, and personally supervised the construction of the "Wampus-Kat." The establishment and construction of the Barnhart Twin No. 15 "Wampus-Kat" was financed by Mr. C. R. Little, a retired business man, who has unlimited faith in the future of commercial aviation. Mr. Murray S. Elton is carrying on the expansion of the organization, sales and works.

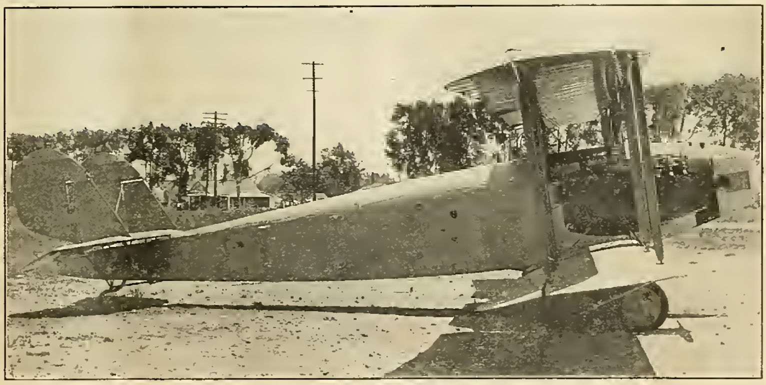
The unique christening of this new machine was held August 3, 1921, under the auspices of the Pasadena Chamber of Commerce, with the Tournament of Roses Association co-operating. While a small girl showered the machine with flowers, Mr. R. Short and Mr. Wally Timm, in a Barnhart machine, flew over and dropped quantities of flowers on the new machine.

A resumé of the report of the test pilot, Mr. G. G. Budwig, is given:

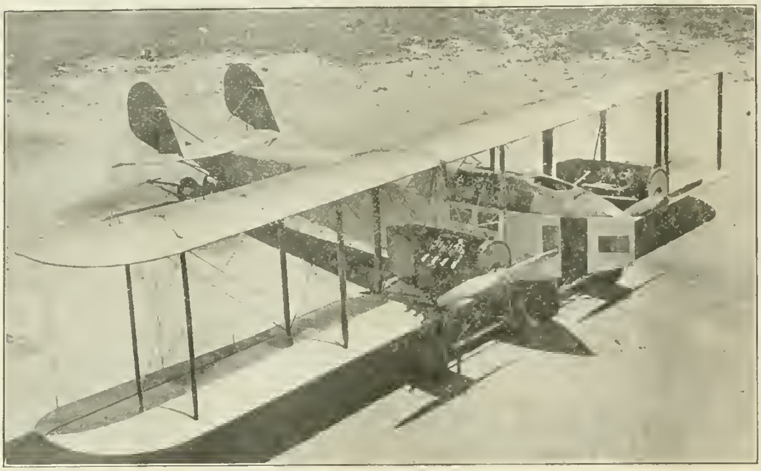
"The performance of the ship shown in the test work done so far is remarkable. The motors both turn the same R. P. M., but are about 100 R. P. M. under normal. This would indicate the propellers were not proper for the engines. It will be within reason to expect a further increase in an already fine performance, as we know a J. N. with the engines turning a 100 R. P. M. under normal would not get off under the same conditions.

Lateral Control

"The Dep" control is used, and is very efficient. The control ratio seems to be correct, and very little movement on the wheel is necessary. The ship has at least fifty per cent more aileron than even an exceptional condition would call for. This control is very natural, both in movement and in results.



Side view of the Barnhart "Wampus-Kat"



The Barnhart "Wampus-Kat"

Horizontal Control

"The elevator control is sufficient to control the ship at all speeds, but does not have so much surplus control as does the aileron. The action on the machine is slower than the aileron action. One unaccustomed to the machine would have the impression that the elevators are too slow in action. However, it is but natural to assume that a long fusilage machine would be slower on the elevators than a short fusilage. Then too, a cargo or passenger machine should have all the smoothness in operation possible, and avoid all quick and violent pitches of the machine. The machine is so stable that the elevator control is sufficient, with a reasonable over-amount. The only benefit in making it faster would be to be more nearly like the average ship in the control.

Rudders

"The rudders are sufficient with a small, but enough, surplus control when but one motor is running. When both motors are running very little rudder is needed to get the desired result. The ratio can be varied very easily to satisfy conditions."

Instrument Board

"All instruments are in full view of the pilot, and mounted so as to be easily readable.

General Performance

"The machine is very easy to fly, take-off and land. It flies very naturally and is very stable. But very little control is necessary at any time, even in rough air. It makes very natural turns to either right or left, and makes them equally well flying level or in a climb. When stalled the ship recovers quickly, and when stalled settles slowly with no tendency to spin or fall violently.

"The horizontal balance is the same whether loaded or empty, flying level or gliding. The addition of load does not change her climb to any great extent. The glide is good, and she keeps her speed at a small gliding angle. The general controllability under all conditions is excellent.

"When one motor quits or is abruptly shut off, the ship does not swing abruptly, but turns toward the dead motor very slowly. There is ample time to stop all turn with the rudder. This is a very great point in favor of the machine.

"The ship flies level on one motor at 2400 feet with 90 gallons of gasoline on board and one passenger. She flies level at 1500 feet with the same gasoline load and two passengers on board. This is, of course, with the one motor only turning 1300 R.P.H., its present maximum. It requires about 2 inches of down aileron and roughly 2/3 of the total rudder. It can be turned to either direction."

A detailed description of the structure follows:

Wing Structure

There are seven wing panels: A top center section which extends from the right engine mounting to the left engine mounting; two lower sections which run from fusilage to engine mounting; the upper and lower outer panels are of same size and shape.

Four ailerons are used and are of ample size to give control at the stalling speed. All aileron control wires are external so that they may be watched.

The machine has no stagger or dihedral. The wing curve is R. A. F. No. 6 A, and is employed on account of its high lift and low resistance.

The struts form a three bay-system with lift wires double and landing wires single. Between the fuselage and engines all wires are double.

The wing spars are of hollow box girder construction with block internal and external strut points. The blocks are all properly tapered so as to allow the bending stress being brought in gradually to the strut points.

The ribs are spruce webs with lightening holes and reinforcement for horizontal shear. The attachment to the spar is "U" shear blocks which insures the ribs and relieves the cap strips of this vertical shear load.

The cap strips are spruce with a groove for the ribs.

All internal and external fittings are of clean cut simple design so that it is possible to produce these fittings in the field and also procure the material, which is mild steel.

The wings are all internally braced for drift which eliminates all external drift wires. The entire internal drift system is double steel wired with turnbuckles for adjustment.

All external strut fitting bolts straddle the spar and are retained from sliding by special blocks and bolts through the neutral axis of the spar which gives the fittings a permanent tie.

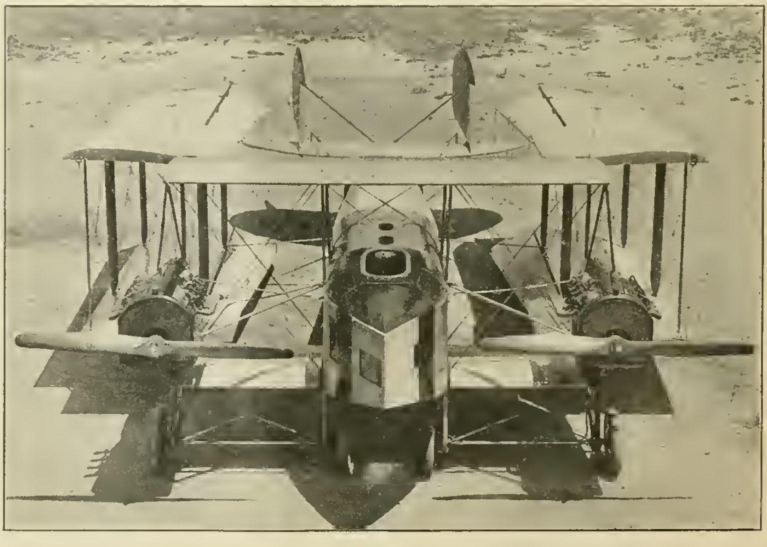
Where the wings join the fuselage, or each other, there are pin joints parallel to the neutral axis of the spars.

The panels are covered with grade "A" linen sewed to the ribs in accordance with government practice, six coats of dope and three coats of Cosmolac vernish.

Folding Wings

To fold the wings requires little or no time, and is accomplished by pulling four master pins and four lock pins. Dummy or auxiliary struts are provided which properly space the upper and lower planes in relation to their fittings. There are also provided spacer bars which tie the wings to the fuselage at the rear outer.

In testing, the machine has been towed over the very roughest ground at 30 M.P.H. with the wings folded and there was no shake to the wings nor was any alignment or tightening of wires required. In trucking a machine to the field, in the customary manner, the machine must be entirely dismantled, and then set up at



The Barnhart "Wampus-Kat" folded

the field. This new machine has been towed through streets and traffic with the wings folded back. After arriving at the field the machine only required a matter of minutes to make ready for flight.

The hinge on which the wings turn is a universal joint so that there can be no overloading of it due to any angularity of the wings or deflection of the spars.

With the wings folded the engines can be worked on with ease; also there is not the danger of tools being laid on the wings or dropping through the wings.

Fuselage

The main load carrying structure of the fuselage is of a fine streamline form and the cabin is constructed so as to give the greatest and proper strength for the least weight and so that repairs or adjustments may be made readily. This structure has four ash longitudinal members and spruce struts for lateral and vertical members. The structure is trussed with high strength steel wire with turnbuckles for adjusting tension of wires.

The floor and dome of the pilot's and passenger's cabin is of mahogany 3-ply wood with natural finish.

The four seats in the passenger's cabin are readily removable which allows the number of people or goods to be carried to be arranged for in any suitable manner of load. There is ample room behind the rear seats for luggage.

Ventilation doors are provided in the dome as well as a large sized door.

Two windows are provided for each passenger and a large negative observation lens is in the floor ahead of the passengers. This lens is in convenient position for all passengers to view the ground.

In general the passengers are provided with a fine opportunity of seeing without any inconvenience.

Ample room is provided so that no passenger will be at all cramped or confined as the floor space is six feet long by forty-four inches wide.

All control wires and attachments are protected against clothing or jamming by passengers or goods.

The cabin walls and cushions are dark grey Fabricoid.

The entrance to the pilot's and passenger's cabin is through the floor in the nose of the machine, and entrance is made with great ease. The pilot's cabin is in the nose and is in front of the passengers. For vision the pilot has three side windows, one floor window, and in addition his head and eyes are considerably above the dome.

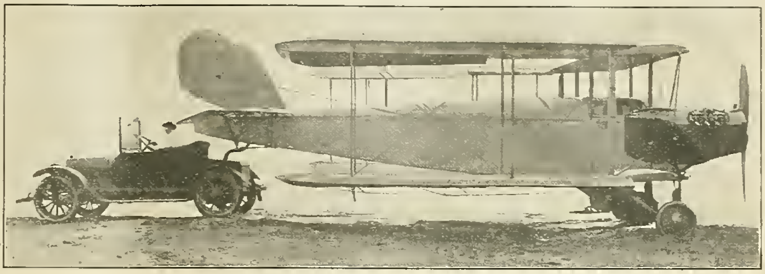
With this arrangement he can watch his engines as well as view the ground and horizon.

Special "Dep" control is provided for elevators, ailerons and rudders. A hand throttle is provided by which one or both engines can be opened or closed. Spark retards extend into the cabin. The ignition switches are within easy reach as are all other controls. The instrument board is composed of one instrument of each of the following for each engine: tachometer, oil pressure gauge, and thermometer. There are also a clock compensated for altitude, and an altimeter.

It is perfectly safe to smoke in the passenger's and pilot's cabin, for there is no gasoline vapor in these cabins.

When in the cabin all is clean, for there is no oil, gasoline, or carbon monoxide as is in most cases true of single engined machines. Dress clothes can be worn with perfect convenience, for no helmet or goggles are needed by the passengers.

The outside of the entire fuselage except the cabin dome is linen covered. The fabric is laced to the longerons and struts. The fabric is laced on three sides of the fuselage, namely, bottom and sides, with a detachable streamline cover for the top rear of the fuselage.


The "Wampus-Kat" as a trailer

The fuselage is large enough for a man to work inside in making any adjustment. With the laced fabric and breaker strips he can open any portion which might require repairs.

The design of the fuselage is such that consistent and uniform strength is maintained throughout and repairs can be easily and quickly made.

Chassis

The chassis is of rugged construction of the four-wheel type. The use of the four wheels allows the machine to ride smoothly over the worst of rough ground and also has the feature of allowing two tires to be blown off without injury to the ship in landing.

The chassis construction is of wood and steel. The four main vertical and diagonal bow struts are nine lamination ash. The front and rear struts are a continuous loop to allow no digging into the ground of the strut ends and to allow a smooth place on which to wrap the shock absorber. The bow struts of ash are 2⅛" x 2" and are streamlined with a hollow spruce fairing. The entire strut assembly is wrapped with linen treated with dope and natural varnished surface.

Steel spools with the side thrust and ground friction arms are used on which to wrap the rubber exerciser cord. There are reach wires which allow the rubbers to absorb six times the weight of the machine. Any additional load in landing is transmitted direct to the struts through the reach cable.

Spreader tubes of steel extend between each pair of front struts.

The bracing is by double steel cable in the plane of the front struts and single steel cable in the plane of the rear diagonal struts.

In every way the chassis is of simple and rugged construction which can be dismounted, adjusted or assembled quickly.

Engine Mounting

The engines are mounted on steel tubing beds with wood vibration breakers. The bracing is of "V" type and all ends are pin-jointed. In this assembly, by removing six main pins the cowling, radiator and engine can be removed as a complete unit. This would mean a great saving in time in the operation of an air line. The cowling, radiator, in fact all could be assembled before setting in the machine—thereby not keeping the machine out of operation as long as by dismantling each component part of the power plant.

The main engine bolts do not pierce the tubing bed but are rings with studs.

The radiator is supported by setting on a felt pad and is tied from the top to keep out fore and aft movement.

As a fire preventative, all structural members are of steel with only a wood vibration strip.

Cowling

The cowling is so arranged that by closing the rear fire door or shutter, it is possible to use any of the gases or liquids for extinguishing any fire.

The entire cowling is of aluminum and is in five removable sections so as to allow for working around any particular part of the engine with ease and without removing any but the one section.

All pipe line constructions are of the olive and special fabric lined moulded rubber hose connections.

The general specifications for B.T. 15, especially designed and built commercial transport aeroplane for handling goods, passengers, and mail, are as follows:

High speed at sea-level	85-90 M.P.H.
Slow speed at sea-level	43-45 M.P.H.
Climb to 3500 ft. with full load in 10 minutes.	
Service ceiling	10,000 ft.
Actual ceiling	11,600 ft.
Total horsepower	180
Total wt. of the machine empty except water	2611 lbs.
Total wt. of the gasoline and oil for 4½ hrs	540 lbs.
Total wt. of the pilot and 4 passengers	800 lbs.
Total wt. of useful load	1404 lbs. or 34.9%
Total wt. of pay load	640 lbs. or 15.93%
Total wt. of the machine fully loaded	4015.065 lbs.
Total wt. per sq. ft. of surface	8.23 lbs.
Total wt. per horsepower	22.3 lbs.
Total span wings folded	22 ft.
Span over all, upper wing	50 ft.
Span over all, lower wing	50 ft.
Chord upper wing	5.5 ft.
Chord lower wing	5.5 ft.
Gap	6 ft. 8 in.
Stagger	0
Dihedral equivalent	1°
Over all length	30 ft. 10 in.
Over all height	11 ft. 0 in.
Wing section high lift and low resistance	R.A.F. 6 mod. A.
Area upper wing (excluding ail.)	233.32 sq. ft.
Area lower wing (excluding ail.)	210.33 sq. ft.
Total area (including 4 ailerons)	484.9 sq. ft.
Area (2 upper and 2 lower ailerons)	41.25 sq. ft.
Area Stabilizer	36.00 sq. ft.
Area elevators (2)	23.00 sq. ft.
Area fins (2)	10.30 sq. ft.
Area rudders (2)	19.00 sq. ft.

The machine has folding wings which will allow it to go into a hangar 22½ feet wide, and 34 feet long, and 11 feet, 6 inches high.

The seats for the passengers can be removed and will allow a space unrestricted by struts, wires or projections of 6 feet long, 44 inches wide and 48 inches high.

THE EMPLOYMENT OF AIRSHIPS FOR THE TRANSPORT OF PASSENGERS

Indications on the Maximum Limits of Their Useful Load, Distance Covered, Altitude and Speed*

By UMBERTO NOBILE

Director of Italian Aeronautical Construction

Technical Note of the National Advisory Committee for Aeronautics

1

As an indispensable premise to this study it should be stated frankly that it is rather risky to judge of the approximate weight of an airship of large cubic capacity,** say, 300,000 cubic meters, by taking as a basis the anticipated weight of a similar airship of small cubic capacity, say, 30,000 cubic meters.

Even were it possible, by applying the principles of mechanical similitude, to establish exact laws of variation for the weights of the various constituent parts of the airship, the previsions would still be far from the reality, especially for very large airships. It may, in fact, happen that with increase of dimensions we find ourselves, at a certain point under the necessity of radically modifying this or that part of the airship, or we shall have to adopt materials having characteristics different from those used in the model, or insurmountable and unforeseen difficulties in workmanship and assembling may constrain us to abandon that type of airship or completely change the cubic capacity.

It is, however, undeniably useful to try to establish, even by a very rough approximation, the laws governing the weight of similar airships which may give a sufficiently clear idea of the greater or lesser advantages to be obtained by a given cubic capacity. But, when, having established these laws, we find, as in fact, we do find, that the unit weight first decreases to a minimum value in relation to the cubic capacity X and then increases until, in the cubic capacity Y (limit cubic capacity) the weight absorbs the whole of the lifting force, we must consider the values of X and Y as being acceptable only as indications of *their order of magnitude*, since it may well happen that, for instance, for one of the reasons above indicated, the limit Y may be reached more rapidly, or even exceeded.

2

In applying, whenever possible, the laws of similitude to airship structures, we will keep in mind:

(a) That the principal static efforts produced, either by weight or by the pressure of the gas, may, with sufficient approximation, be considered as proportional to the cubic capacity V. Consequently, the stresses in the various parts are proportional to V, and therefore the weight is proportional to $V^{4/3}$.

(b) That the main dynamical efforts due to air pressure, are proportional to $V^{2/3}$ and consequently the weight of the various structures varies proportionally to V.

3

We will limit our investigations to the semi-rigid Italian T type, but it is obvious that, by generalization, the law of variation that we shall establish is applicable to any other type of airship and, in particular, to the rigid Zeppelin type, with some slight modifications in the numerical coefficients introduced in the general formula expressing the weight of the airship in function of the volume and maximum velocity.

By the maximum velocity of the airship we mean that velocity which it can safely develop at a low altitude, say, at 300 m. above sea level. This velocity, expressed in km/h., we indicate by w.

In speaking of the weight of the airship we will consider the following parts:

The external envelope and accessory organs;
The stiffening part of the bow of the envelope;
The stabilizing and control planes (keel and rudders);
The frame structure and accessories;
The maneuvering devices (landing, mooring, etc.);
Electric light plant, wireless plant, fans, etc.;
The pilot's cabin;
The passenger cabin;
Reservoirs for benzine, oil, and water.

Besides this, in order to complete the evaluation of the weights which, unlike those of the fuel and the useful load, remain constant, and cannot be dispensed with, we will also consider the following weights:

The crew;
Engine spare parts and various necessary tools;
The reserve ballast and the ballast corresponding to the first 300 meters;
The reserve stock of benzine and oil.

4.—The Envelope

The envelope comprises:

The external envelope of the gas bag;
The separating diaphragm between the gas and the air, commonly called the internal ballonet;
The ballonet on the beam;
The transversal diaphragms;
The connection between the frame with the keels and rudders;
The gas and air valves with their corresponding controls.

In the rubber-covered and varnished envelope employed in the various parts of airships, we must always distinguish the weight of the canvas part from the weight of the rubber and varnish applied to it. The function of the rubber is essentially to render the bag gas-proof and, consequently, in theory, by fixing the tolerance limit of the daily penetration of air in a cubic meter of hydrogen, the weight of rubber for every square meter of the gas bag surface may decrease with the increase of cubic capacity. In practice, however, for various considerations we may assume the unit weight to be about constant, and therefore the total weight of the rubber may be taken as proportional to $V^{2/3}$. The same proportion holds for the weight of the varnish.

External Envelope.—The weight of the external part of the gas bag minus the weight of the rubber obtained as specified above, may be taken as proportional to $V^{4/3}$. In fact, while from one side the surface increases as $V^{2/3}$, on the other hand, the tension (and consequently, for the same specific resistance, the thickness also) increases in proportion to the pressure and to the radius of curvature, that is, in proportion to $V^{1/3} x V^{1/3}$.

Diaphragm Separating the Gas from the Air.—This gas tight diaphragm, interposed between the hydrogen and the air, must never come under tension. It must serve only as a means of holding the rubber and therefore its total weight may be taken as proportional to $V^{2/3}$.

Transversal Diaphragms.—These must be capable of withstanding a given difference of pressure between two adjacent gas compartments. It is, however, rational to consider such difference as being proportional to the mean pressure of the gas and, therefore, proportional to $V^{1/3}$. Consequently, we may assume that the total weight of the diaphragms varies in proportion to $V^{4/3}$.

Implicitly we have also assumed that the number of diaphragms is always the same.

Connecting Links.—The tensions in the links connecting the external gas envelope and the longitudinal beam (catenaries) are proportional to V. The weight of such elements is therefore proportional to $V^{4/3}$.

Regarding the elements or links connecting the envelope with the keels and rudders, it should be remarked that, as we shall see later on, the total forces acting on them are proportional to $V^{2/3}$. Also, the stresses to which are subjected these connecting links (except the stresses produced by inertia) fall under the same relation of proportionality, and therefore the weight of these connecting links will vary in proportion to V, considering that their length increases in proportion to $V^{1/3}$.

Gas Valves.—For simplicity's sake we will assume that the dimensions of these valves remain always the same.

In this case, increasing the pressure of the gas in the proportion of $V^{1/3}$, the holding power of each valve increases in the ratio of $V^{1/6}$. It follows that the number of valves, and consequently, their total weight, varies in proportion to

$$\frac{V}{V^{1/6}} = V^{5/6}.$$

In order to avoid introducing this new exponent, considering also the relative smallness of this weight, we will assume that the weight of the gas valves is proportional to $V^{2/3}$. On the other hand, this difference in the law of variation may be realized by suitably increasing the dimensions of the lifting part of the valve only, up to the limit allowed by the strength of the other parts.

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*From the "Giornale dei Genio Civile," Anno LIX, 1921.

**For the sake of simplicity and clearness we shall use no unusual or out-of-the-way terms, but only such as are in current use, as cubic capacity, empennage, ballonet, etc.

Control Cables.—According to the hypotheses given above, the weight of the cables controlling the valves is numerically proportional to $V^{2/3}$, while their length is proportional to $V^{1/3}$. We may therefore take their total weight as proportional to V.

It should be remarked here that, in practice, constructors will probably avoid having an excessive number of valves and valve controls which would entail a more rapid variation of weight, unless the structure of the valve could be altered for the purpose of making it less heavy.

Air Valves.—In this case, considering the less favorable conditions of functioning, we must assume the pressure to be constant. We may therefore assume the number of valves, and consequently their total weight to be proportional to V.

Consequently, the weight of the control cables increases in proportion to $V \times V^{1/3} = V^{4/3}$.

Total Weight of Envelope.—We have now analyzed the weights of the various parts of the envelope of our model airship, and thereby obtain the following expression for computing the total weight of the envelope:

$$2.410\ V^{2/3} + 0.008\ V + 0.00374\ V^{4/3}.$$

5.—Stiffening of the Bow

The unit pressure exerted by the air on the surface of the stiffened part of the bow is proportional to the square of the velocity. Since, however, the linear dimensions are proportional to $V^{1/3}$, the bending moments, and consequently also the resulting stresses, are proportional to $V^{1/3}v^2$. On the other hand, the total surface varies in proportion to $V^{2/3}$. It therefore follows that the total weight is proportional to $V\ v^2$.

In order to be exact, we should also consider the secondary stresses due to the weight itself, stresses which, of course, increase more rapidly than the preceding ones. These, however, are negligible especially in the upper part which rests on the envelope.

In the case of our model, the total weight of the stiffened bow (including its covering) is given by:

$$10^{-6}\ .\ 1.3\ V\ v^2$$

where, as always, V is expressed in cubic meters, and v in km/h.

6.—Stabilizing and Control Planes

It is extremely difficult to establish a law governing the variation of the weight of the stabilizing and controlling organs, and would first of all require a close examination of the various points connected with these functions, an examination which we cannot enter into here.

We will therefore make only a rough approximation by the aid of simplifying hypotheses. For instance, we shall not distinguish between the fixed and mobile planes, assuming that, according to the requirements of steering, a greater or smaller part of the total surface area may be rendered mobile without greatly affecting the mean unit weight.

Vertical Planes.—Considering only the stabilizing function, it is evident that the total area of these planes must be proportional to the surface area of the envelope, if the righting moment due to the action of the air on the former is to be proportional to the upsetting moment caused by the action of the air on the latter.

On the other hand, the unit pressure may be assumed to be constant, and it then follows that the total weight of these planes varies in proportion to V.

If we now consider the variation of speed, it is evident that, for increased speed these planes should be suitably strengthened, though it is difficult to establish a priori in what measure this should be done. But on the other hand, with increased velocity the deviations due to the disturbing cause diminish, and therefore if we wish to keep the stability constant we may reduce as required the area of the planes. So that, for the sake of simplicity and as a rough approximation we may say that the total weight of these planes is independent of v.

Horizontal Planes.—For these planes we might employ the same general considerations as for the vertical planes, were it not that the case is rendered more complex by the static righting moments which increase in proportion to $V^{4/3}$. However, considering only the stabilizing function, the total area of the planes in question may increase less rapidly than $V^{2/3}$, and therefore the total weight may vary less rapidly than V.

When, instead, we consider the regime of movement along inclined trajectories, we easily come to the conclusion that if we wish, for instance, to maintain the maximum climbing speed unchanged (that is equal to horizontal velocity, the maximum tangent of the angle of climb), it is necessary to increase the angle of attack, thus bringing about an increase in the unit pressure and therefore in the unit weight.

It is also useful to consider that by increasing V the mobile part of the horizontal planes must increase more rapidly than the fixed part. This may lead to notable modifications in the design which, in turn, will produce new uncertainties in the evaluation of the weight itself.

From the various considerations so far made, we may conclude that, as a rough approximation, the weight of the horizontal planes varies in proportion to V.

For our model we find that the total weight of the empennages may be expressed by 0.043 V.

Rudder Controls.—The forces acting on the rudder control cables may be taken as proportional to $V^{2/3}$ and likewise their sections. Their weight is therefore proportional to V.

In our case, comprising also the control devices in the pilot's cabin, we have, for the total weight, 0.004 V.

7.—Longitudinal Beam

The complexity of the forces acting on the framework (longitudinal beam) makes it extremely difficult to establish a formula giving the variation in weight with sufficient approximation. We will again refer to the exceptions made at the beginning of this paper and here also, for the considerable item of the weight of the airship, we must be satisfied with a rough approximation.

The longitudinal beam is simultaneously acted upon:

(a) By the static forces due to the loads it has to sustain, namely, the keels, rudders, power plant, fuel, and useful load. The total weight of all these loads is represented by the difference between the total lifting force, f V, and the sum of the weights of the envelope, the larger part of the keels, and part of the stiffened framework. This weight can, therefore, only be expressed by a rather complex function of the volume.

However, on analyzing the above mentioned expression, we find that this total weight may be taken, with an approximation of 5%, as proportional to V.

On the other hand, for obvious reasons it would be difficult to vary the volume without altering the distribution of load in the model. Since it is evidently impossible to provide beforehand for such variations and even more impossible to account for them, we must inevitably accept the simplifying hypothesis that the distribution of load remains the same.

Admitting this hypothesis, we are justified in saying that the forces due to static loads are proportional to V and consequently, that the weight of the longitudinal beam increases in proportion to $V^{2/3}$.

(b) By the dynamic forces brought about by the action of the empennages. These forces, according to the considerations made above, must be taken as proportional to $V^{2/3}$ and therefore the increase of weight in the armature due to them is proportional to V.

(c) The dynamic forces due to the thrust of the propellers, or, which is the same thing, the reaction exercised by the air on the various parts of the airship when its axis is parallel to the line of flight. This reaction is proportional to $V^{2/3}\ v^2$ and consequently the resulting efforts in the armature vary according to the same law of variation.

We must however distinguish between v constant and v variable when evaluating the increase in weight due to these forces.

In the first case, combining the dynamic forces in question with the maximum least favorable forces enumerated in (a) and (b) (calculating these by means of various hypotheses on the distribution and value of the useful load and of the load of fuel, oil, and ballast) the result is that the increase in weight in the armature due to such forces, remains always proportional to V.

Things are much more complicated when the velocity is taken as being variable, because in that case, for a sufficiently high value of that velocity it may happen that, at a given moment, the reacting force of the thrust of the propellers in a given element of the armature will prevail over the forces a + b, thus giving rise to an increase in the weight of that element, which does not happen in the model due to the fact that the sign of the maximum resulting effort is reversed. It is easily understood that, under these conditions, it is not possible to find the means of accounting for such an eventuality.

However, considering that the dynamic forces of this category are small when compared with those of the two preceding categories, and considering also that the velocity limits attainable are relatively low, we shall be able to say, with a degree of approximation sufficient for the nature of our study, that the increase in weight due to the thrust of the propeller is proportional to $V\ v^2$.

In the case of our model, summarily analyzing the effects due to the three kinds of forces mentioned above, we will consider that a sufficiently clear statement of the total weight of the longitudinal beam is given by the following formula:

$$(10^{-6}\ .\ 0.5\ v^2 + 0.022)\ V + 0.00236\ V^{4/3}$$

8.—Accessories of the Longitudinal Beam

We shall consider as accessories the covering of the beam, the internal gangway, and the pneumatic shock absorbers.

The prevailing forces are those due to the action of the air. In consequence of these forces the weight of the covering of the beam varies in proportion to $V\ v^2$ and, for our model we have : $10^{-6}\ .\ 1.3\ V\ v^2$.

The Gangway.—We should remember that live loads, though remaining invariable in absolute value, increase numerically at least in the proportion of $V^{1/3}$. Therefore, assuming that the width of the gangway remains the same and that the number of supports remains also the same, the bending moments increase proportionally to $V^{2/3}$ and likewise the weight itself.

It is probable, however, that the constructor gains in weight by increasing, if possible, the number of suspensions of the envelope, but, on the other hand, it is probable that this will involve increasing the width of the gangway. In conclusion, therefore, it seems that we are justified in assuming the weight to vary in the proportion of $V^{2/3}$ as stated above.

For our model we have: $0.374\ .\ V^{2/3}$.

Shock Absorbers.—The forces to which the shock absorbers are subjected are about proportional to the cubic capacity of the airship. We may therefore assume that their number or length must be increased with increased cubic capacity, leaving the width unchanged. In that case the total weight will increase in proportion to V. For our model the value is 0.003 V.

9.—Engine Sets and Supports

After determining the maximum velocity which the airship must be capable of attaining, the power required may be taken as proportional to $V^{2/3}\ v^3$ and in inverse proportion to the propeller efficiency:

$$N = \frac{k}{\eta}\ V^{2/3}\ v^3$$

For our type of airship, expressing v in km/h, we may assume:

$$k = 10^{-6} \times 1.05$$

and therefore for $\eta = 0.7$.

$$(1) \qquad N = 10^{-6}\ .\ 1.5\ .\ V^{2/3}\ v^3\ *$$

We may admit that the weight per horsepower, which we will call π remains constant, and we may also admit that the weight of all the accessories (radiators for water and oil, taken as full; piping system; starting devices; controls; instruments; propellers) is proportional to the power and averages 0.65 kg. per h.p. For engines weighing 1.20 per h.p. we may therefore consider the total weight of the engine set to be about 1.85 kg. per h.p.

As regards the supports, the forces to which these are subjected are partly static, proportional to the weight of the engine set and therefore to $V^{2/3}\ v^3$, and partly dynamic proportional to the thrust of the propellers. If we assume, therefore that their number remains unchanged, their weight must increase in proportion to V.

Such an hypothesis is, however, hardly probable, since it is certain that, in order to obtain a better distribution of load, the number of supports must be increased. Such being the case, we will simply assume that their total weight is also proportional to the power developed by the engine set which, in our case, is given by 0.25 kg. per h.p.

Summarizing the total weight of the engine set we have:

$$(\pi + 0.65 + 0.25)\ N = (\pi + 0.90)\ 10^{-6}\ .\ 1.5\ .\ V^{2/3}\ v^3$$

and for $\pi = 1.20$:

$$10^{-6}\ 3.15\ V^{2/3}\ v^3$$

(To be continued)

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[*] For the various types of airships constructed by us so far, we have found coefficients varying from 1.45 to 2.10. In our future constructions we shall presumably reach somewhere below 1.4. For Zeppelins the coefficient is smaller.

OFFICERS

Joseph A. Steinmetz, *President*
1421 Chestnut Street
William H. Sheahan, *1st Vice-Pres.*
J. Sidney Owens, *2d Vice-Pres.*
George S. Gassner, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. Bamberger
Charles L. Hower
George S. Ireland
Frank A. L. Leahy
John W. Pratt
D. J. Spence, Jr.
A. Stanley Truscott

Interesting letters are being received by members of the Club from Mr. Joseph A. Steinmetz, the president, who is at present journeying in France and England. The following airgram was sent by Mr. Steinmetz to the *London Mail* as soon as the death of Mr. Hawker was announced:

"American Society of Mechanical Engineers, Aero Club of Pennsylvania and associates in aviation express heartfelt sympathy upon sad news of Hawker tragedy. The world can illy afford to lose such splendid men and when automotive engineers determine cause of such accidents must remove menace, particularly if caused by leaky tanks and uncertain fittings.

"Joseph A. Steinmetz,
"President Aero Club of Pennsylvania."

It now appears that there was no defect in the plane as later investigation shows that Hawker met his death through physical disability. For a long time he had suffered from tubercular disease of the spine and in the opinion of the medical profession of a hemorrhage had taken place in the air, causing paralysis. The opinion that the machine caught fire is an error as according to several witnesses the plane was not on fire while in the air, the only flames being seen were those which one would naturally expect to see issuing from the exhausts.

The Philadelphia Aero-Service Corporation have started a real innovation at the Official Flying Field of the Club at Warminster. As an experiment short flights were offered for the very small amount of five dollars a trip. This caught the popular fancy with the result that they have had about as many "air tourists" as they could handle and the planes are in the air from ten o'clock in the morning until late in the afternoon. Longer trips are given at correspondingly low rates, but the short trip seems to have caught the fancy of many who just want to "try the air" and tell their friends of the experience.

The sympathy of the Club is extended to Lieutenant Louis M. Robb, former army flier who in a forty mile race with death on the night of July 27th reached the bedside of his mother within a few minutes after she had died.

Lieutenant Robb was at Parkesburg, Pa., with his plane when news reached him that his mother had been taken with a serious illness. Jumping into his machine he flew it swiftly toward Philadelphia. As darkness was rapidly coming on he was forced to fly at a very low altitude. When he reached 69th Street he landed in an open field before a crowd who at first feared that the machine had been damaged. He arrived at his home just after death had overtaken his mother.

A most inspiring spectacle was the flight on August 1st of the sixteen bombing planes over the city. The wonderful sight of sixteen of the largest planes of the army, Martin twin Liberty motored machines, as they flew over the City Hall will long be remembered. The deep "drumming" of the powerful engines was heard for miles and the flying in formation across the city, down over the edge of League Island Park, then on to Hog Island was a most practical demonstration of how easily the country could be bombed by a hostile air fleet once it reached this country; or what is of more importance, how readily such a fleet of aeroplanes or even battleships could be repelled if Philadelphia possessed ample planes to protect against such an attack.

The next stated meeting of the Club will be held at the club rooms, 1026 Walnut Street, at 8 P. M., September 16th. A large attendance of the members is requested as business of importance will be brought before the meeting. Reports of the various committees will be made and a course of activity for the coming months will be mapped out. The annual nominations for elections will be held in a few months and there is a growing feeling among the older members and those who have held office for many years that as the Club now has so many active new members who are working hard to build up the membership, they should be honored by election to office.

It is planned to arrange to hold a photographic contest for the Henry M. Neely cup in the early spring. No contest has been held for this trophy for many years and as interest in aeronautical photographic work is being shown by the new membership of the Club it is believed that such a contest would arouse much interest and would help in the drive for membership which will be carried on during the Fall months.

The Biddle cup for Model Contests now holds a prominent place in the Club room and it is hoped to have the Neely cup placed beside it with the name of the latest winner properly inscribed upon it.

W. H. Sheahan,
1st Vice President.

NAVAL and MILITARY · AERONAUTICS ·

Forest Fire Patrol Work

What the Air Service is accomplishing along the line of forest fire patrol work and the method of operation is partly shown by the following outline of the work carried on during the months of May, June and July by Flight B of the 12th Observation Squadron, the headquarters of which is at Nogales, Arizona:

Geographical survey maps marked off into corrdinate sections were used; on spotting the fire the observer communicated with the nearest radio station. Radio stations were located at Tucson and Nogales landing fields. In making the radio report the following method was used:

(a) Station call, three times.
(b) Key letter for route and observer.
(c) Fire—FFF.
(d) Old fire—O. New fire—N.
(e) Location by coordinates.

The maps were coordinated into five mile squares, which were further subdivided into one mile squares. In reporting a fire its location in the five mile block was first given as, for example, 1-K. It was further located in the one mile square by the additional coordinates of the one mile square in which the fire was located. The one mile squares were divided usually into four quarters. The upper left hand corner numbered; the upper right hand corner 2; the lower right hand corner 4; and the lower left hand corner 3; thus placing the fire within one quarter of a mile of its location. A typical location might be "7 K 3 A 2." This would locate a fire in the five mile block, 7 K; in the one mile block 3 A, and in the upper right hand quarter mile section. The system of coordinating was a very simple one, as follows: each five mile block was numbered from left to right and lettered with capital letters from top to bottom, the one mile squares were similarly numbered from left to right and lettered from top to bottom with small letters.

(f) Area in acres—A15 (fifteen acres) AS (less than one acre).
(g) Cover—CT (Timber)
CB (Brush)
CO (Open)
CX (Burned or cut over)
(h) Slope—SL (Level)
SG (Gentle)
SS (Steep)

Report on slope was followed by direction letter, N.S.E.W. Thus a typical report under (h) would be "S G N," indicating sloping gently to the north.

(i) Ground wind velocity and direction as, for example, "15 N" would indicate north wind of 15 miles per hour. If there was no wind the observer reported "No" under (i). Thus a typical fire report would be "ZD, ZD, ZD, XY, FFF N, 7K 3B1, AS, CB, SGS, 15N."

Immediately upon receiving the radio report, the operator relayed the report to Forestry Headquarters by telephone.

The observer made record of all information sent by radio and turned this information in at the radio station immediately upon landing. This information was telephoned to Forestry Headquarters to act as a check on the radio communication. The observer while patrolling, if there are no fires to report, nevertheless communicated with the radio station every ten minutes as follows:

(a) Station call repeated three times.
(b) Key letter for route and observer.
(c) RAS—signifying nothing to report.

The observer was required to check out with the radio station by a system of panels before leaving the vicinity of the airdrome to insure that his radio set was properly functioning. For this purpose each observer has a key letter, also a key letter for the route he is patrolling and a corresponding panel for key letter.

A coordinated map is kept in the flight operations room. All forest fires were marked on the map. Active fires known and located were marked with red-headed pins, old fires extinguished were marked with black-headed pins. New fires discovered by the observer and not notified by Foresters were marked with yellow-headed pins. The pilot and observer were required to report to the operations room and carefully study the map, verify the location of all fires on their maps, and receive such other information and instructions that might pertain to the day's patrol. Immediately upon landing the pilot and observer again proceed to the operations room, reporting all information they have gained.

During the time of this patrol Forestry officials were permitted to ride over the forest areas patrolled, in order to assist them in fighting fires. In each case the Forestry officials were required to apply in writing to the camp commander. The usual release form was used in every case, and a report of each such flight made with the name of the Forestry official, was submitted to Corps Area Headquarters.

Aerial Regulation of Heavy Field Artillery Fire

The U. S. Army Balloon School at Lee Hall, Va., adjoins Camp Eustis, the home of the Heavy Railroad Artillery, and as considerable firing was done this summer, the observers had excellent practice in regulating the shots. Whenever the weather permitted, the balloon was in ascension, although owing to the shortage of personnel it was necessary to call cooks from the kitchen, and get out every other available man on the ropes, and it was only when lightning appeared that the balloon was hauled down.

The artillerymen had a number of ground O.P.'s in tall towers for terrestrial observation, and employed the usual method of having observers report the impact on the Observation-Target Line. The balloon was about nine kilometers from the target, and invariably gave readings on the Battery-Target Line, though on several occasions the angle between Balloon-Target and Battery-Target was large. During the course of a shoot, the balloon was frequently complimented by the battery on the accuracy of the observations, as the greater height of the Observer's Position enabled the actual point of impact to be reported.

At the various artillery critiques following the shoots, the accuracy of balloon observation was brought out, and that from the balloon observations alone the guns are regulated efficiently. The results were very gratifying, as it was recognized that in the presence of an enemy ground observation would be difficult and often impossible, especially for the Railroad Artillery, firing at long ranges. Under these conditions, balloons are of immense assistance. The cost of firing 8" and 12" guns from railroad mounts is very large, and accurate fire, regulated from actual observation of the effect of the fire, is a necessity.

The growing importance of heavy artillery has increased the necessity for aerial observation. Before the war, only a few 8" guns were mounted on railroad mounts, but now all sizes up to 14" are mobile. It is expected in the future that most of the counter-battery work will be done by railroad guns.

In the last two months the observers at Lee Hall have regulated about 1,000 3" shots, 200 8", and 200 12" mortar. The balloon is especially valuable for calibrating a piece, as very accurate observation is essential. Also the use of the balloon demonstrates in the regulation of several batteries at once the rapidity with which observation may be reported by direct telephone communication furnished by the balloon.

Orders and Assignments at Langley

The following changes in assignment and duties of officers of the Lighter-Than-Air division have been made: Lt. Robert V. Ignico who for some time has been in command of the 19th Airship Company, is relieved of that duty and assigned as a student officer for the course of instruction in the Airship School. Lt. Carlton F. Bond has been relieved as commanding officer of the cadet detachment and assigned to the command of the 19th Airship Company. Lt. O. A. Anderson is relieved from further duty with Airship Company No. 10 and assigned to command the cadet detachment.

A number of enlisted men were placed on duty requiring regular and frequent participation in aerial flights. Included in this number are: Corporal Grove J. Drake, of the 1st Squadron (Observation) and Master Sergeant Harry A. Chapman, Master Sergeant William F. Fitch, Pvt. 1st c. Bruno E. Elfstrom, Pvt. 1st c. Harry D. Ritchey, Pvt. Willard N. Edson of the 19th Airship Company.

Having completed the temporary duty to which he was assigned at Langley Field, Captain Clyde V. Finter has been relieved from further duty here and ordered to report to his proper station for regular duty.

Staff Sergeant Harry W. Johnson of the 14th Squadron has been detailed on special duty with the Photographic School for the purpose of taking a course of instruction in aerial photography.

Captains John G. Colgan and Victor Parks, Jr., are among the recent arrivals at Langley Field, reporting for duty in the Field Officers' School.

Pvt. Hans L. Thompson, 96th Squadron (Bombardment) has been detailed on special duty in the Engineering Department.

FOREIGN NEWS

France To Organize First International Air Navigation Congress

Under the patronage of the French Under-Secretary of State for Air, the French *Chambre Syndicale des Industries Aéronautiques* has taken the initiative in convening an International Air Congress, to be known as the First International Air Navigation Congress, and to be held concurrently with the next Paris Aero Salon, from November 15 to 26, 1921, to afford an opportunity of discussing the various problems connected with commercial aviation. The President of the organizing committee is Monsieur P. E. Flandin, late Under-Secretary of State for Air, who will be assisted by a number of well-known French experts as vice-presidents. The President of the Technical Committee will be M. R. Soreau, who is President of the Aviation Commission of the French Aero Club. The Air Navigation Committee will be under the presidency of Col. Sacconey.

By inviting communications from all interested in the question of commercial aviation, it is hoped to establish an interchange of ideas which will be of great help in the furtherance of aviation all over the world, and give an opportunity of discussing such problems as affect the future development of commercial flying. Those who wish to help in any way towards the success or the Congress can do so in two ways—by becoming full members or by becoming associate members. The fee charged for the former has been fixed at $5.00. Full members are entitled to send in communications to the Congress, and will also receive a *résumé* of the communications. Payment should be by check or money order, made out to the *Chambre Syndicale des Industries Aéronautiques,* 9. Rue Anatole de la Forge, Paris (XVIIe). At the conclusion of the conference the proceedings will be published in full, and a copy of the published report will be obtainable by associate members as well as full members for the price of $5.00.

Printed forms of application for membership, as well as intimations of papers or communications which it is intended to submit to the Congress, can be obtained from the General Secretary, International Air Navigation Congress, 9. Rue Anatole de la Forge, Paris (XVIIe).

Communications should be kept as short as possible—about 2,000 words will be a suitable length—and should be typewritten on one side of the paper only. Line drawings may accompany the communications, but they should be carefully drawn, and the space available for their reproduction is limited to two pages of the report of the Congress. Communications and papers should be submitted before October 15, 1921, so as to ensure a *résumé* being printed in time for the Congress. Papers which arrive after that date will not be published until the issue, after the Congress, of the Proceedings.

Papers and communications may be written in either of the following languages—French, English, German, Italian, or Spanish.

With regard to the papers submitted, these should bear on one of the following subjects:

(A) Technical Committee

(1) The utilization of results of wind tunnel model tests for full-size calculations.

(2) Aeroplanes and seaplanes (monoplanes or multiplanes). Thick and thin wings. All-metal structures and composite structures.

(3) Airships with great carrying capacity.

(4) Commercial aero engines; their arrangement in the machine, and their transmission gear.

(5) Apparatus for fixing the position of an aircraft and of tracing its route.

(B) Air Navigation Committee

(6) Air routes.—Outline, management, wireless, meteorological information, aerodrome installation and ground organization.

(7) Commercial aviation.—Commercial machines (aeroplanes or seaplanes, passenger, goods and mail machines). Charts. Organization and exploitation of regular air lines. Air mail.

(8) Air legislation.—Regulations, Customs, Examination of personnel and material. Safety. Insurance.

Federation Aeronautique Internationale

It was decided to place the following subjects on the Agenda for the Conference of the Fédération Aéronautique Internationale to be held in Madrid in October next:

Aircraft Customs. The Institution of the Tryptique.

Superior Brevet.

The fixing of the dates for all International Competitions nine months beforehand.

The following delegates were appointed to represent the Club at the Madrid Conference: Lieut.-Col. F. K. McClean, Lieut.-Col. Alec Ogilvie, Lieut.-Col. Mervyn O'Gorman, C. B., Mr. H. E. Perrin (Secretary).

Gordon Bennett Balloon Race

The decision of the Meeting of the Bureau of the Fédération Aéronautique Internationale held in Paris on June 30, 1921, to regard the frontier as the landing place in the event of landings in Russia, was reported and agreed to. It was reported that the Race would start at Brussels on September 18, 1921.

French Military Casualties

The French Minister of War has just published a statement of the casualties of military aviation in the first five months of this year. From January 1 to May 31, 1921, 35 airmen were killed and 34 injured. These figures do not include airmen killed or wounded by the enemy in the Levant or Morocco. Nineteen of the accidents are described as being due to "pilot's error."

British Air Mail

In a despatch to the *London Observer,* Major C. C. Turner writes of the air mail as follows:

The unusually long spell of fine weather has been partly responsible for the punctuality of the air mails, which was recently the subject of the Postmaster-General's congratulations; but the hardest critic of air transport will admit that some little credit must also be given to the aeroplanes, engines, pilots, and organization. It is, however, necessary to bear in mind that bad weather is as certain to come as next Christmas. Now is the time to prepare for it, and to ensure that there shall be no falling off in the air mail.

Something is being done, but this is confined to a slow improvement of the average quality of the machines. With painful deliberation, additions to the cross-Channel squadrons are being made, and some of these additions are of the later types. One or two new De Havilland 18's are being used, and there are rumors about the Handley-Page W8 (both old types, but curiously hard to get). One of the new Bristol-450 h.p. Napier ten-seaters has appeared on the scene. It is said to have been "approved" under the Air Ministry's new subsidy scheme. It is high time that the De Havilland 29, a cantilever ten-seater monoplane with a 450 Napier, was put into service. With such machines as these the British lines would have nothing to fear from foreign competition. One is constrained to ask, not what, but who, is keeping British aviation back?

The Air Ministry have inspected types submitted under the new scheme, and have approved of some of them, but no orders have yet been placed. Yet there are not enough machines to cope with the present cross-Channel traffic, and the average quality of those machines is far below what it need be.

Among the new proposals is one for a resumption of the British services to Brussels and Amsterdam. Another relates to a new type of aeroplane and system of operation. The machine has easily detachable wings, engines, and fuselage, and this will obviate the need to keep reserves of complete machines and will facilitate repairs and regularity. The machine, having cantilever wings, will need comparatively little truing up. Here we see a suggestion of system; undoubtedly one of the drawbacks of the existing state of affairs is the employment of too many types by too many companies.

The Air Ministry plan of approving air transport firms using approved machines in order to benefit by the easy purchase and new subsidies schemes is excellent. Ignorant official opposition to inland air mails continues. When the new scheme bears fruit—as it possibly may in the course of time—some of the recommendations of the Aeronautical Society will see fulfilment. At present these improvements (which had for long been advocated) are simply ignored. They concern such matters as the elimination of rubber connections in the petrol installation, the abolition of propeller swinging, the provision of convenient emergency exits, easily removable engines, controllability at landing speed, and so on.

The Air Ministry are not responsible for all defects. For example, owing to the delay of the ratification of the International Air Convention they are unable to ensure the inspection of foreign-owned aeroplanes using British ports. There was a case recently in which insurance was refused, yet the machine started. The Board of Trade would not permit that sort of thing in the case of ships; why should air transport suffer this grave prejudice?

Little or nothing is being done towards the establishment of organization to deal with breakdowns and to carry on night services. Yet there will be no excuse if when the dark days come there is not full provision in all these matters. Except sheer lack of purpose, or deliberate obstruction, there can be absolutely no reason why the winter should not find the London-Continental services prepared for day and night flying in all weather except such violent storm or dense fog that puts rail and boat traffic also out of gear. The knowledge and the means are available.

Steam Engines for Airships

Invention of a system of steam propulsion for airships is claimed by Captain W. P. Durtnall, who was a British naval officer during the war, and up to a year ago staff captain in the chief mechanical and electrical engineers' department of the Royal Air Force.

It is maintained that the new system will function at altitudes hitherto unattainable with the ordinary type of internal combustion engine.

The invention is said to do away completely with the ordinary boiler, the steam being generated by means of internal combustion power or heat energy. The superheated steam heat energy is supplied to special steam motors which are reversible and can be controlled from a central control station. Only heavy oil is used as fuel, and it is claimed that the driving machinery can be safely placed inside the frame of the airship instead of in separate gondolas outside, thus bringing about a great reduction in air resistance and consequently reducing the power required for propulsion.

The engines or "steam motors," as Captain Durtnall calls them, are of the double-acting type, requiring no flywheels.

Aeroplanes and Grasshoppers

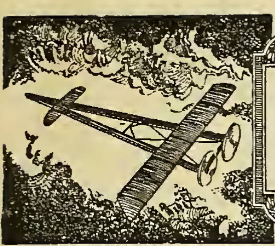
It is reported that aeroplanes are doing useful and most unusual work in France dealing with the plague of grasshoppers on the Crau Plateau (northwest of Marseilles) which is far more serious than it was last year, crops of all kinds being destroyed over some 100,000 acres. Pilots report breeding grounds and scatter poisened bran.

Dutch Line Extensions

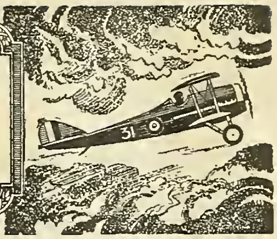
It is reported that a regular air service is to be inaugurated between London and Amsterdam, with connections to Hamburg, Copenhagen and Berlin, with a fleet of Fokker commercial monoplanes which are now being built in the works of the Fokker Company at Amsterdam. The service will, by means of the interior German lines, connect with all principal German cities; while the route to Copenhagen will be extended by a seaplane service to connect with Sweden. These Dutch-built machines will be equipped with Siddeley Puma engines, which was the make used by Lieuts. Parer and McIntosh on their flight from London to Australia.

Trans-Atlantic Flying Ships

According to the London "Daily Mail" the Fairey Company, builders for the British Air Ministry of the great Titania flying boats, have in hand plans for giant Transatlantic flying ships, driven by specially designed 4,000 horse-power engines, which will have luxurious accommodation for as many as 100 passengers, in addition to fuel, crew and stores. They will, in fact, be air liners, with great hulls which, seen without their wings, one might mistake for some specially designed craft for use on the surface of the water. Starting from the lower reaches of the Thames, such vessels will be able to make a non-stop flight to New York in very little more than 40 hours; while calculations which have just been made show that with a sufficient fleet, well patronized, the fare by flying ship should be little, if any, more than by steamship. Conditions in the flying ships will approximate almost exactly to those of first-class steamship travel. Guided on their course by directional wireless, informed in advance of weather changes, and with a motive plant which is practically immune from the risk of breakdown, they will offer not only speed and comfort but also safety.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



How to Build a Scale Flying Model of the Curtiss 18-T Triplane

THE Curtiss 18-T Triplane, described in AERIAL AGE, March 31, 1919, has recently been drawn up and described by Mr. C. H. Fastje. Mr. Fastje has made some very complete detailed drawings of this model but owing to lack of space it is possible only to publish a general outline plan which has been prepared especially for AERIAL AGE. Those desiring additional information on the construction of this model should communicate with Mr. Fastje at Dennison, Iowa.

The following description gives a very good idea of the manner in which to proceed in the construction.

Fuselage Construction

Secure two pieces of balsa wood 3" x 4". and two feet in length. Make a cardboard outline of the top view of the fuselage. Lay this outline or template on the balsa pieces (on the 4" sides) and mark the outlines. Cut to within about 1/32" of the outline, preferably on a bandsaw or a jig-saw. Then with the use of the template, carve out the insides of the balsa wood pieces to about 1/8" of the outside outline mark. Then the side outlines of the fuselage are drawn by using a cardboard outline of the side view. Saw out as before, on a bandsaw or jig-saw.

Work the outsides down with the use of the templates for the outside of the fuselage. Sandpaper both inside and outside of the pieces, enough to take off the rough spots and leave a shell approximately 1/8" in thickness throughout.

Cut each piece to the correct length, shellac both the inside and outside of both pieces and let dry. Then cut all the holes and places as shown for the main plane spars, landing gear struts, tail skid, stabilizer and rudder. The openings for the stabilizer plane are made by cutting grooves 1/32" deep.

Insert and nail and glue the motor stick brace in the upper piece after the openings for the cockpits and gunner's seat openings have been cut out *with care.* Be sure that both pieces fit perfectly and smoothly. Smear plenty of glue on each piece and bind together tightly with silk thread and leave set until thoroughly dry. Trim and smooth up the cockpits carefully as shown. Glue the 1/8" thick piece of veneer or wood to the front end of the fuselage, so that the nose-piece may be securely fastened to the fuselage later on.

Main Plane Construction

First of all make a pattern of the ribs out of cardboard. Lay this pattern on a balsa wood block and draw the outline. On a drill press drill the holes where the spars and edgings are to fit in. Saw out the outline on a band or jig-saw. Then cut the block thus sawn out into ribs 3/32" thick. Thirty-one ribs for the main planes are needed. The ribs may be cut from 1/16" thick white pine wood if desired. Next make the 5/32" round spar material by cutting or planing 3/16" sq. white pine wood to octagon shape and then sandpapering to 5/32" round shape.

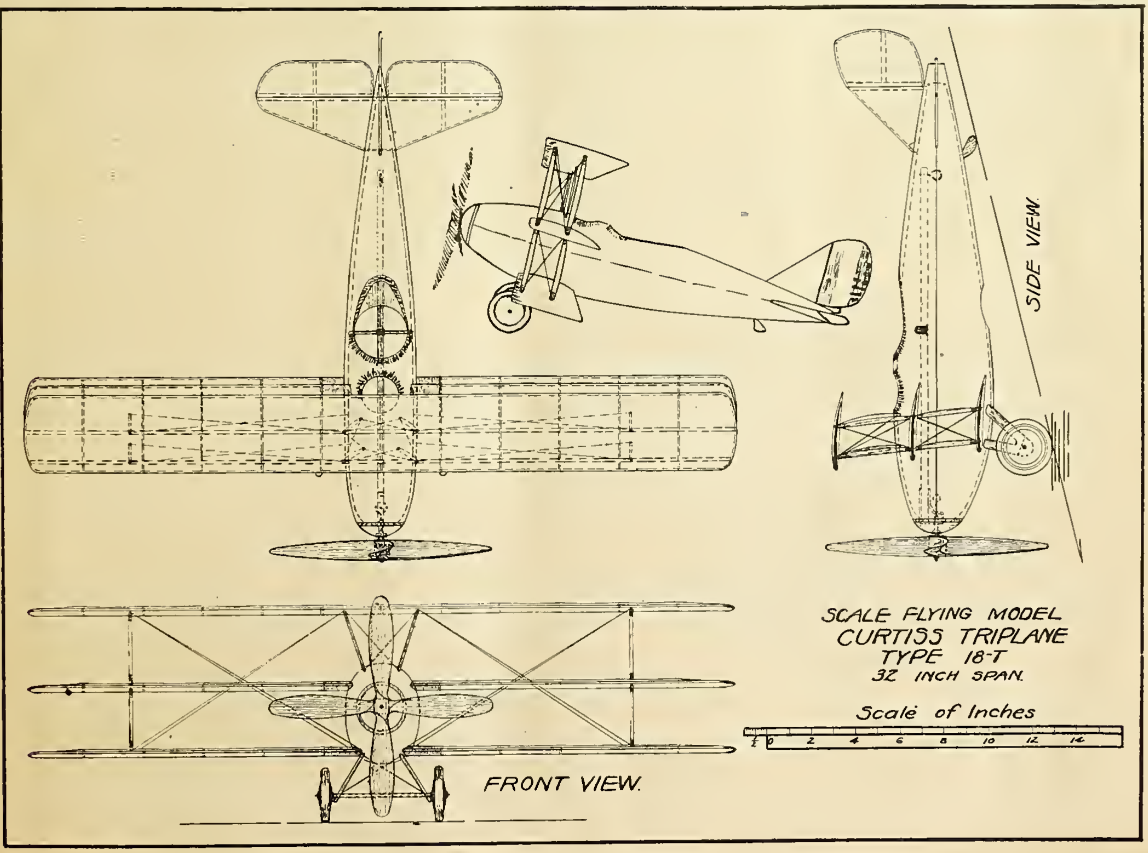
Spars for the upper plane are in one piece while the spars for the middle and lower main planes are only one-half as long. When the spars are cut, mark on them the positions of the ribs. Slip the ribs over the spars in the positions marked on them. Glue them and square up. Set away to dry.

In the meantime, bend the bamboo edging to shape over a candle flame. Cut out the balsa wing sections with the grain running from the leading to the trailing edge. Secure the bamboo edging to the ribs by silk thread and glue. Slip the balsa wood wing sections on for the lower and middle planes and glue fast.

When the frames are rigid and dry, drill the 1/16" holes for the interplane strut, fastening as shown. Wrap with thread and glue so spars will not split when the interplane struts are attached.

Cover the frames with silk or silk tissue paper. Cut out the interplane struts. After the ends of the struts are wrapped with silk thread, drilled and smeared with glue, insert the aluminum wire pieces in the ends.

(*To be continued*)



A-E-R-O-N-I-T-I-S

The Aviator

By Ethel Trew Dunlap

My ship is ready and waiting to rise
Into the boundless sea of the skies.
The sun is shining and tinting the sky
With fairy colors that charm the eye;
Yet my thoughts are as cold and gray
As the path that will mark my way.

The bloom and fragrance of summer skies
Will vanish like breath when I arise.
The sailors who man their ships at sea
Are not as steady as I must be;
With eagle watchfulness I must keep
A constant vigil to sail the deep.

Drifting between the heavens and earth
The spirit is re-created in birth.
I fling defiance to airy clouds—
I mock at their fingers that wave white shrouds
The stars attract with their sylvan lights
And dim forms allure me to higher flights.

I scorn their allurements while I fly
Steady and swift through the heart of the sky.
There are sirens in the depth of the seas—
And there are sirens in heaven's breeze;
The currents of air are their mystic wings,
And they follow my ship while it flies and sings.

Forgetful of danger and gravity's tie
I fasten my gaze on the quiet sky.
Out of the silence and night-time's gloom
Science and hopes for the future bloom—
Bathed in the mystic light of the stars,
And streaked with the flashing glow of Mars.

We have measured the earth and fathomed the sea—
So heaven must yield us her mystery.
She hath hung her lamps in the kingdom above
To show the sublimity of her love.
And though I return to my earthly ties
My hopes remain in the heart of the skies.

The Homing Bird

By William S. Savage, R.M.A.

Far to the East a mere speck in the air
 I saw, and simultaneously my ear
Caught a faint sound born of the object there
 Which, as I watched, seemed rapidly to near.

Across the evening sky in homeward flight
 The aeroplane approached—passed overhead;
Its sleek wings flashing in the fading light
 Transformed to silver shafts the sun's gold red.

Suspended high in space twixt ground and sky
 To gravity a loud defiance roared;
And then, to shame the grace of birds that fly,
 It dipped its wings towards earth and upward soared.

Just then I saw beneath those upturned wings
 Identity revealed in colors bright—
A mark composed of three concentric rings:
 America's design, Red, Blue and White.

Symbolic of our strength above the earth
 In seas of space as yet unchartered; And
I thought of its significance and worth:
 The best defensive weapon of our land.

To think that thing of grace and beauty could
 Wreak grim destruction and perhaps did hold,
Behind its frailty of cloth and wood,
 Potential possibilities untold.

It has, of late, conclusively been shown
 That numbers of these ships of air can go
Far seaward and, their presence all unknown
 Rain poignant death on navies far below.

I pictured fleets of these in future days,
 Helping defend us from aggressive wars,
Moving upon invisible highways,
 To vulnerable points on far-flung shores.

Gazing above I saw (grim thoughts now done)
 The Homing Bird race with descending night—
A shrinking silhouette against the sun,
 Receding Westward quickly fade from sight.

A Handy Receptacle

"Bobby, what did you do with your peanut shells in the car?"

"I put 'em in the overcoat pocket of that man I was sittin' by."

Cured

"I'll fine you $10 for contempt of court."

"All right, your honor. I'll pay it, but it's a lucky thing for me that you don't know what I'm thinking."

"I'll just add another $10 for that remark."

"Your honor, my mind is now a perfect blank."

Birmingham Age-Herald.

For the past six months the skirts have been advertised as "coming down." The goods are not as advertised.

First Gob: Going to church services?
Second Ditto: No, I don't need the sleep.

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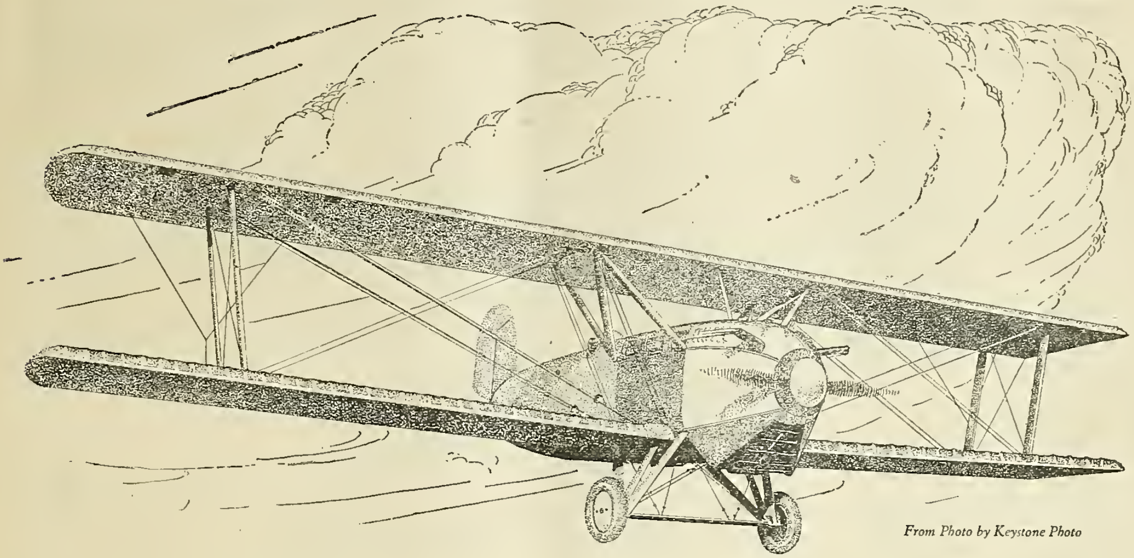
"A patent has been issued for a silk gauze face shield to keep dust from the eyes and noses of automobiles."

—Eugene (Ore.) Daily Guard.

Good Reason

Belle: I don't understand why Clarice lets that common grocery boy play around with her.

Buoy: Neither do I, unless it's because he delivers the goods.—*Penn State Froth.*



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Two Records—

MANY notable planes have been designed by Mr. Donald Douglas, former Chief Engineer of the Glenn L. Martin Company. But none of them is more remarkable than the "Cloudster," recently built by his own company — the Davis-Douglas Company of Los Angeles.

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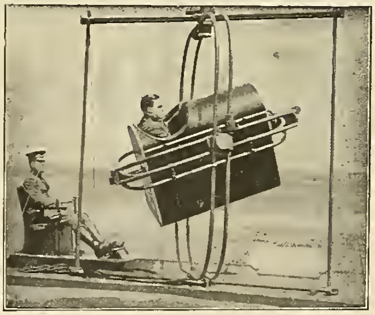

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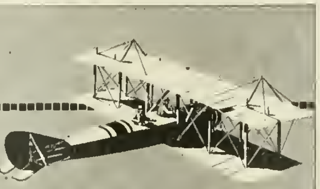

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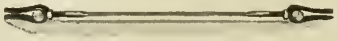

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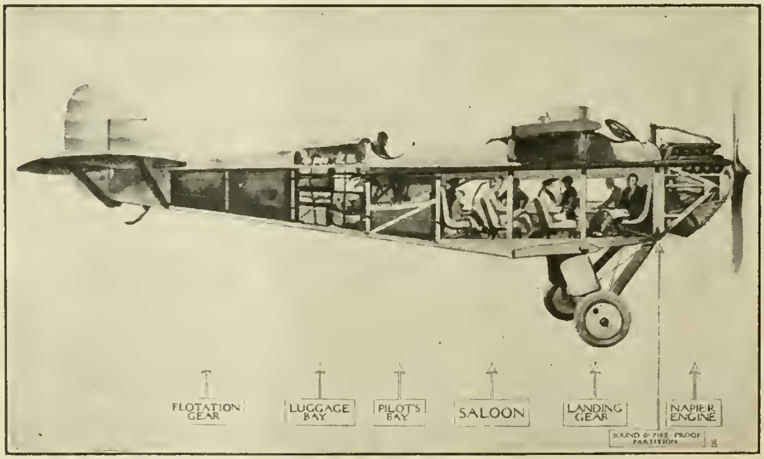

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AERIAL AGE WEEKLY

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Weight Estimation in Aeroplane Design

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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September 12, 1921 AERIAL AGE WEEKLY **VOL. XIV, No. 1**

TABLE OF CONTENTS

Weight Estimation in Aeroplane Design 3
The News of the Week............ 4
U. S. Post Office Air Mail Department 5
The Aircraft Trade Review 6
The Winner of the London Aerial Derby 7
The Problem of Fuel for Aviation Engines 8
The Employment of Airships for the Transport of Passengers.......... 12
Naval and Military Aeronautics.... 15
Foreign News 16
Elementary Aeronautics and Model Notes 17
Aeronitis 18

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WEIGHT ESTIMATION IN AEROPLANE DESIGN

AEROPLANE design within the past few years has become less an art and more a science. Sound, painstaking engineering is taking the place of inspiration and intuition. This change has been made possible only by the gradual accumulation of accurate data on aeroplanes of various sizes and types.

Perhaps the most important single class of data which designers must have is that relating to aeroplane weights. For centuries naval architects have been collecting data on the weights of ships of every kind and the furnishings and equipment put into them. The success or failure of a ship design is largely dependent upon the accuracy with which the designer estimates his weights. A ship when launched and loaded must float on the designed water line. Fully as necessary for ships of the air as for ships of the sea is a knowledge of their weight, ready to fly.

Many factors are dependent upon the weight assumed at the beginning of a design. Among the most important of these is the strength. It is useless to carry through a careful stress analysis of the different parts of the structure, designing them for a certain load factor based on an assumed weight, and then discover too late, after the aeroplane has been built, that the weight estimate was 10 to 15 per cent in error. If the assumed weight was too low the structure is unsafe; if it was too high, the design is unnecessarily heavy, and could not compete with an aeroplane which did not have to carry around a few hundred pounds of useless, dead weight that should have been disposable load. The next factor to be seriously affected by an error in the weight estimate is the wing loading.

With a given wing section the wing area is determined early in the design either by considerations of maximum landing speed or of desired performance. Should the actual gross weight be considerably in excess of that estimated, the wing area provided would be inadequate. It is extremely awkward, usually, to increase the wing area of an aeroplane already built. Even should the higher landing speed, due to overweight, not be excessive, either the performance and maneuverability of the aeroplane are impaired or the disposable load largely reduced. In the old days when a designer was thankful for whatever load his aeroplane would carry and did not worry particularly if the performance was low, this matter of overweight did not trouble him greatly. Today, however, the standards are set so high that a designer with all the skill and knowledge at his command can hardly meet them. He cannot afford to run over his estimated weights by more than a small margin. The fundamental importance of accuracy in weight estimation is evident.

Unfortunately the data which designers must use in the preparation of weight estimates are neither very abundant nor too correct. A common cause for error, particularly in the case of the fuselage weight, is not due to a mistake in recording the correct scale reading but in failure to note in detail exactly what was weighed, whether or not the fuselage contained tanks, seats, controls and other furnishings. Some of the lack of accuracy in weight data can be attributed to the fact that information of this kind may become obsolete because of alterations in the design of the parts weighed.

Data relating to older designs are either entirely inapplicable to new types of construction and materials or can be used only with the most careful judgment. For example, weights of the structure of aeroplanes built of wood are of no value in preparing a quantitative weight estimate for an all metal aeroplane. Also, the weight of the cellule of an externally braced wing furnishes no accurate guide to determine the weight of an internally braced wing. A large increase in size in aeroplanes of the same type of construction, employing the same materials may greatly alter the ratio between the weights of the various parts of the aeroplane structure and the gross weight of the aeroplane. The proportion between the disposable load of an aeroplane and its entire weight influences the proportion between the weight of the structure and the gross weight. With a given power plant and factor of safety, the larger the disposable load the smaller becomes the percentage that the structure forms of the total weight. Again, if the disposable load remains fixed and the weight of the power plant varies, the ratio between the structural weight and the gross weight will vary, assuming the safety factor to be constant. As the pounds per horsepower become higher the structural weight of an aeroplane will become a larger proportion of its total weight. It is obvious what the effect of increasing the safety factor will be on this ratio.

These are some of the reasons why it is so difficult to get satisfactory results from existing weight data, especially if the information is not recent. Aerial Age within a few weeks will contain several articles which will do much to aid designers in the preparation of trustworthy weight estimates.

B. C. B.

THE NEWS OF THE WEEK

Memorial Service for ZR-2 Victims

The people of Hull, where the tragedy of the dirigible ZR-2, which was wrecked last week, participated September 1 in a big memorial service for the victims.

Preceding the service at the Holy Trinity Church, there was a procession from the Guild Hall, in which marched the Lord Mayor, the Sheriff and other city officials. United States Consul Grout was the chief mourner for the American dead. In the procession were representatives of local civic bodies, units of the British Army and Navy, Commander Byrd, with officers and men of the United States Navy at Hull, two officers and six men of the American Air Service detachment at the Howden aerodrome, Air Vice Marshal Vyvyan of the Royal Force, and representatives of the Y. M. C. A., headed by George D. Whitehead, Senior Secretary of the American Y. M. C. A. in England.

Despite rain thousands of persons lined the route of the procession. The black worn by the clergy and the main body of marchers was relieved by the vivid colors of the robes of municipal officials. They wore the full insignia of office over the quaint costumes prescribed by ancient customs, the Aldermen in scarlet and the Councilors in blue. The mace bearer and Town Clerk preceded the Lord Mayor, who, in resplendent regalia and gold chain, led the procession. Consul Grout accompanied the Lord Mayor.

A contingent that added impressiveness to the column was composed of the Trinity House Brothers, a rich and famous charitable society dating back to the thirteenth century.

From public buildings the Union Jack floated at half mast.

Although Holy Trinity Church, which was built in 1306, is the largest parish church in England, it was unable to accommodate more than a fraction of those seeking admittance. Seats were reserved for the large number of relatives of the victims and for Rear Admiral Haworth, as well as for his three daughters, one of whom was engaged to one of the British officers of the airship who lost his life.

The service was conducted by the vicar of the church, Canon George Buchanan. It was concluded with the national anthem and "The Last Post," by a bugler of the naval band. While the band played Chopin's funeral march a number of women were overcome, several of them fainting.

The American and British flags were entwined about the altar. Canon Buchanan in his sermon remarked that "the very nature of the tragedy will draw the two nations more closely together."

With the finding of Commander Maxfield's body, only four American victims remain unaccounted for.

Sir Richard Gregory Criticizes Air Ministry

In an article on the R-38 disaster in *Nature*, a weekly scientific magazine, edited by Sir Richard Gregory, the British Air Ministry is sharply attacked for its alleged lack of experimental and research work on airships.

"Airship design as known to us," *Nature* says, "has been a matter of guessing and not of calculation founded on scientific knowledge. The policy first dictated by the Admiralty and more recently by the Air Ministry has never given any effective opportunity for the accumulation of scientific knowledge, on which alone a rapid advance in construction could safely proceed.

"Having neither knowledge nor experience of our own, Great Britain has been reduced to copying, as faithfully as possible, such German designs as we have been able to capture. That a lack of knowledge and not any concession to essential utility accounts for the present calamity may be inferred from the fact that the weight of the girders of the gas fabric was much less than half the gross weight of the ship, and that a modification of the proportions of the total weight could have been made for the purpose of strengthening the girders had the necessity been foreseen.

"The Air Ministry has assumed a great responsibility by its failure in the last two years to provide adequate facilities for fundamental research on airships."

Sidney Veit Knight of the Legion of Honor

Mr. Sidney B. Veit, an old American resident in Paris, of 98 boulevard des Batignolles, has been awarded the rank of knight of the legion of honor by the French government for services rendered in commerce, aeronautics and war relief work.

Mr. Veit, who has spent a great part of his life in Paris, is engaged in the export and import business principally between the United States and France. He is a strong promoter of artistic efforts of beginners and is one of the founders of "Les Amis des Artistes" which aids needy artists by the purchase of their works.

He is greatly interested in aeronautics and is the honorary secretary of the Foreign Service committee of the Aero club of America. During the war he was one of the organizers of the American aviators' club in the Champs-Elysées.

One of the recent accomplishments of Mr. Sidney B. Veit, in conjunction with a group of friends, including particularly Dr. A. L. Hipwell of 91 avenue des Champs-Elysées, is the raising of funds for the erection of a monument to the soldier dead of Barbizon, a little town on the edge of the forest of Fontainebleau.

Landing Field at Springfield

An aeroplane landing field has been established at Springfield, Vermont, largely through the initiative of Governor Hartness, who is keenly interested in aeronautics.

Amphibious Planes for London-Paris Trip Service

Experiments will shortly be made with a view of organizing a Paris-London air service with amphibious machines which will be able to carry passengers from the centre of one city to the centre of the other.

Convenient points will be chosen in the Thames and the Seine where the machines will alight on the river. The machines will be so built that they can also, if necessary, land at aerodromes and other convenient points in case of engine trouble.

The advantage of this means of transport will be to shorten considerably the time now necessary in order to travel by air. The aerodromes are far from the centre of the cities and much time is lost by automobile transport to starting points and from landing places. It will also be possible to reduce the price of the journey owing to this suppression of its automobile section.

Spirited Debate on Aerial Law

Spirited debate developed when the report of the special committee on the law of aviation came before the American Bar Association convention in Cincinnati. Charles A. Boston of New York, Chairman of the committee said: "The United States is pitifully behind some of the smaller nations of the world in the development of aeronautics, and it is imperative that something be done to bring this country forward."

"Other nations," he said later, "have adopted laws covering the air and the United States is technically under an aeronautical boycott.

"The lack of law has several drawbacks that have stood in the way of development of commercial flying. This committee has learned that the law is defective, and not the aircraft. Capital does not want to invest in its development under present conditions."

Mr. Boston declared that it was the opinion of the committee that, to put the United States on an equal basis with other countries in aviation, it would be necessary to resort to constitutional amendment.

He moved the adoption of the following recommendations made to the Executive Committee:

"First—That the members of the association be requested to give their attention to the fundamental problems of jurisprudence, and especially of constitutional law, involved in the proper solution of the demands of aeronautics.

"Second—That a copy of the report of the committee be placed in the hands of the President and each member of Congress and each member of the National Advisory Committee for Aeronautics and in the Library of Congress and the Smithsonian Institution, and that two copies be given to each of the Commissioners of uniform State laws, and that 1,000 copies be made available for distribution to those especially interested in the subject, to the end that its subject matter may be duly considered in the enactment of any legislation.

"Third—That the American Bar Association at the annual meeting express its hope that, in the enactment of any legislation by the Congress, the most careful preliminary consideration be given to the constitutional features of any proposed legislation, to the end that it may be determined whether the proper development and regulation of aeronautics does not require a constitutional amendment conferring complete jurisdiction over aeronautics upon the United States through its appropriate departments, instead of attempting to adopt devices of questionable constitutionality to make existing national powers apply to this new branch of human activity; and that, meanwhile, all national legislation studiously observe the existing constitutional limitations and preserve without assault the existing division of powers between the United States and the States of the Union; and that all constitutional State legislation involving matters of purely local interest and application shall be studiously made uniform. That the committee be continued as a special committee of the association."

William V. Rooker of Indianapolis led a fight against adoption of the report, urging more immediate action toward the passage of aviation laws. Mr. Rooker declared that the recommendations attacked the patriotism and integrity of Congress.

"When the matter of aviation," he said, "was brought up before this convention I did not know that it was going to hamstring this industry. I ask the American Bar Association if it will adopt a thing on the theory that 'the world is flat'? You cannot partition the ocean or the air."

After giving reasons why aviation should come under the Admiralty laws, Mr. Rooker said: "If this committee wanted to work off stocks and bonds of a railroad, and was jealous of the ocean and the air, it would be a good way to begin."

Mr. Boston jumped to his feet, demanding that he be recognized as a point of personal privilege. Before he could reply, however, Mr. Rooker withdrew his statement.

W. J. Davis of California, who said he had been a member of the Air Service, declared passage of the recommendations would cripple aviation for two years.

He moved the adoption of a substitute recommendation, asking Congress immediately to legislate for the regulation of aircraft, and leaving Congress to determine the question of constitutionality. This motion was voted down.

Mr. Boston, in closing the debate, answered the charges made by Mr. Rooker, declaring that the committee had no intention of attacking the integrity of any member of Congress or any other person.

A second substitute offered was voted down, and by a large majority the recommendations of the committee were adopted.

3½ Mile Gliding Record

A report September 2 from Hesse-Cassel, Prussia, said that an engineer named Klemperer succeeded in traveling five kilometers (3⅛ miles) in a monoplane without an engine, covering the distance in thirteen minutes. He is said to have started from a point 920 meters high, and to have maintained that level about ten minutes.

Chinese Aeroplane Gives Excellent Performance

WASHINGTON—Several successful flights have been made with a hydro-aeroplane constructed by Chinese engineers at the Chinese Government Dock & Engineering Works at Foochow, according to a report made to the Bureau of Foreign and Domestic Commerce. All the material used in the construction of this plane, which was specially designed by a Chinese engineer, with the exception of the engine, which is of American design and manufacture, was produced in China. The works have several more of this type of aeroplane under construction for use by the Chinese navy. The success so far achieved is expected to give quite an impetus to aviation development in China.

Engineers to Meet October 10

Several hundred American engineers will foregather with representatives of the principal engineering societies of Great Britain and France at a dinner to be given at the Engineers' Club in New York on the evening of Oct. 10.

The dinner, while formally celebrating the homecoming of the mission of American engineers who went abroad to confer the John Fritz Medal upon Sir Robert Hadfield of London and Eugene Schneider of Paris, will mark the launching of a new movement to bring English and American engineers together. The profession hopes to open up a fresh channel of international amity, paralleling broadly such contacts as those established by the Carnegie Endowment for International Peace, the Sulgrave Institution and the English-Speaking Union.

The guests at the dinner will include the twelve members of the deputation which represented the John Fritz Medal Board and representatives of the British and French societies by which they were received. Invitations have been extended to many men prominent in public life, including Herbert Hoover, Secretary of Commerce; Viscount Bryce and Charles E. Hughes, Secretary of State.

Others who will attend are the governing boards of the four national engineering societies, the John Fritz Medal Board of Award, the Library Board of the Engineering Societies and of the Engineers Club; the Trustees of the United Engineering Society, and the officers of the Federated American Engineering Societies, from the presidency of which Secretary Hoover retired soon after he became a member of the Cabinet.

Hoover Plans Regulations For Commercial Aviation

Washington, D. C.—Investigation into the probable scope of government regulation of commercial aviation under proposed legislation has been begun by the Commerce Department, Secretary Hoover said Sept. 5.

Government supervision of air traffic along the lines of rail and water regulation was recommended. he said, by a committee of experts of the War, Navy and other departments to increase the safety and more efficient development of the new method of transportation.

Enactment of enabling legislation, Mr. Hoover indicated, probably would result in the creation of a bureau of aviation charged with the enforcement of the rules of air travel similarly to the activities of the Bureau of Navigation in connection with water carriers.

Chicago Aerial Derby

As a special Labor Day event the Aero Club of Illinois organized an aerial derby exclusively for J.N. machines equipped with 90 H. P. motors. Following is a list of the pilots entered: Elmer Partridge, William Westlake, James Curran, Dick Bookland, Nelson Kelly, Price Hollingsworth, James Pugh, Pop Keller, David L. Behnke, Bert Blair, Dan Kiser and Charles Dickinson. The results of the contest will be published in our next issue.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, July, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
														Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
															hr. min.			
Eastern New York-Chicago.....	$5,029.87	$1,068.92	*$7,632.08	$3,123.75	$1,803.32	$695.18	$3,536.00	$1,553.55	$4,873.15	$5,621.65	$2,792.43	$876.19	$38,606.09	13,772	507 54	43,220	$74.81	$0.89
Central Chicago-Rock Springs.	6,551.03	1,542.11	3,158.15	4,302.62	1,017.96	288.05	3,089.89	2,249.97	5,969.75	4,821.18	4,044.21	1,268.97	38,303.89	22,361	667 32	62,639	57.98	.61
Western Rock Springs San Francisco	3,733.24	766.68	**9,522.49	2,332.70	1,144.60	225.82	2,678.63	1,553.56	3,793.24	3,469.35	2,792.43	876.19	32,889.13	12,492	469 00	42,825	70.13	.77
Totals and Averages....	$15,314.14	$3,377.71	$20,312.72	$9,759.07	$3,966.08	$1,209.05	$9,304.52	$5,357.08	$14,636.14	$13,912.18	$9,629.07	$3,021.35	$109,799.11	48,625	1,644 26	148,684	$66.76	$0.73

* Includes new engine in plane No. 191.

** Includes new wings on planes Nos. 74, 104 and 149.

Cost of dismantling College Park Field, formerly on New York-Washington Division....	$1,442.58
Loss on unrepairable crashes....	20,000.00
Permanent improvements....	2,769.56
Total operating costs....	109,799.11
Grand Total....	$134,011.25

Overhead consists of: Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio.

Maintenance consists of: Miscellaneous; Mechanics and Helpers; Repairs and Accessories and Warehouse.

Flying consists of: Gas; Grease and Oil, and Pilots.

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern....	$0.23	$0.25	$0.41
Central....	.15	.23	.23
Western....	.18	.20	.39
Entire Service....	$0.18	$0.22	$0.33

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

An Aeromarine Record

A new world's record in aerial transportation is announced in the official report concerning the operations of the giant flying cruiser Santa Maria, which was forwarded to the Bureau of Aeronautics of the Navy Department by Aeromarine Airways of New York. The Santa Maria is the largest passenger carrying flying boat in the world in daily operation; it has accommodations for eleven passengers, and a crew of four. Since she was launched a little over a year ago she has flown 20,000 miles without a single accident to her passengers.

The big flying cruiser is now at Peoria, Ill., ready to start on the final leg of an aerial circumnavigation of the Eastern section of the United States, which when completed will aggregate more than ten thousand miles. The Santa Maria has already flown from Cuba by way of New York and Montreal, Buffalo, Cleveland, Detroit and Chicago to Peoria, carrying eleven passengers and their baggage. The flight included a circumnavigation of the Great Lakes.

She is now about to fly down the Mississippi River to New Orleans and thence to Vera Cruz, Mexico, here she will take part in the aeronautical exposition, as the largest craft of her kind in the world.

Among her passengers on the forthcoming flight, which commences Thursday, September 1st, will be Congressman F. C. Hicks, chairman of the House Committee on Aeronautics, and a representative of the United States Army Air Service.

The Santa Maria has two Pullman cabins with reclining chairs for her passengers. She is equipped with two 400 horsepower Liberty motors, and has a speed of approximately one hundred miles an hour, but generally cruises at eighty miles an hour.

Her ten thousand mile flight around the Eastern section of the country was undertaken for the purpose of demonstrating the possibilities of commercial air transport in co-operation with the U. S. Navy.

The flight of the Santa Maria along the Atlantic Coast up the Hudson and around the Great Lakes has been met at every city with tremendous receptions headed by the Chamber of Commerce and various civic organizations, and in a statement just issued by C. F. Redden, President of the Aeromarine Airways Company, it is quite probable that the operations of his company—which now include a daily passenger and mail line between Key West and Florida and points up and down the Atlantic Coast—will be extended to cover many points on the Great Lakes and up and down the Mississippi River.

Maquire Quick Service

As United States Army aeroplanes were included in the military forces concentrated in the West Virginia Coal Mine Riot Zone, The C. L. Maguire Petroleum Co., on Sept. 2nd subsequently received an order for 2 cars of Lakeside Aviation oil to be shipped direct to the military command in the riot area.

An outstanding feature of the transaction was the service given the order by the Maguire Company who dispatched the shipment by express within 24 hours after the order was placed.

Robertson Aircraft Enlarges

The Robertson Aircraft Corporation, due to the increased volume of business, has found it necessary to enlarge its quarters and have consequently moved to its new quarters at 5248 Oakland Ave., St. Louis, Mo., immediately opposite the St. Louis Municipal Flying Field in Forest Park (The U. S. Mail Field).

Palmer With Air Service Co.

Capt. W. W. Palmer, distinguished aviator, and formerly Flight Commander with Eddie Rickenbacker's Hat-in-the-Ring Squadron, has accepted the position of General Manager of The Air Service Company of Cincinnati, and will make his home in Cincinnati henceforth. Capt. Palmer was several times decorated during his service overseas, and wears the D. S. C., and the Croix de Guerre.

The Air Service Co., under Capt. Palmer's management, will open a forty-two acre field, on the outskirts of the city of Cincinnati and the company is now prepared to care for visiting flyers. Oil, gas, repairs and all other accommodations are now available.

Successful Fokker Demonstrations

The first of the Fokker F 3 monoplanes which has been christened the "Half Moon," after the tiny Dutch ship in which Hendrik Hudson came to this country and sailed up the Hudson River in the year of 1609, has now carried over 700 passengers since its appearance at Hazelhurst Field on July 21st.

Very successful demonstrations during which hundreds of people were introduced to the delights of a commercial aeroplane as a means of travel, were held at Washington, D. C., Hartford, Conn., and Camp Vail, New Jersey. Bert Acosta, who piloted the machine, appears thoroughly in love with his mount.

From point of view of economical transportation, the Fokker machine is believed to have made a record gasoline consumption during all this flying working out at an average of 8 gallons per hour.

The Netherlands Aircraft Manufacturing Co., believe that by interesting the public in aviation in this way and showing what modern commercial planes can do, they will pave the way for the establishment of air transportation as a recognized means of traffic in this country, as it already is in Europe.

Schroeder with National Aircraft Underwriters

Major R. W. Schroeder, who established the world's altitude record in a flight at Dayton, Ohio, by ascending 33,114 feet, has joined the staff of the laboratories of the National Aircraft Underwriters' Association. Major Schroeder, who was for several years chief test pilot of the United States Army Air Service, will now take a leading part in the classification of aeroplanes and aviators for insurance purposes.

New York-San Francisco Tour

Mr. James Otis, president of Otis, McAllister and Company, exporters, of San Francisco, completed on August 30th the Trans-continental Tour from New York to San Francisco by aeroplane which was begun on August 23d.

Mr. Otis purchased on August 18th, from the Aero Import Corporation a three place Ansaldo Fiat aeroplane of the model known as A300-3. He left Mineola on the twenty-third with the pilot of the Aero Import Corporation, Mr. Lloyd Bertaud, flying the plane, and the corporation's chief mechanic, Gio Campiglie, as the third passenger. No attempt at speed was made and flying was done only for five or six hours daily.

The only incident in the long trip was a short delay due to the malfunctioning of one magneto, and the trip has demonstrated again the sturdy reliability of Ansaldo aeroplanes and their Fiat motors.

The plane bought by Mr. Otis was the one used on the night of May eighth, when this ship covered the distance between New York and Chicago in seven hours five minutes flying time.

Mr. Otis is one of the first of the prominent business men in California to seriously consider flying as a means of fast transportation. The plane in which he made the run across the continent is the second Ansaldo aeroplane which he has owned.

Dayton S. A. E.

The Dayton Section of the S. A. E. expects to hold its first fall meeting about Oct. 1. The subject will be radiation and will probably be treated by one of the officers of McCook Field. About Dec. 1 a paper on lubrication will be given, and in February one on all-metal aeroplane design.

Gliding in Germany

A very interesting glider has been built and flown by Herr Hans Richter, who was one of the first experimenters with gliders in Germany. He began his gliding experiments in 1908, and is said to be the earliest of all glider fliers now existing in Germany, being in fact the first German glider after the late lamented Lilienthal. In the glider produced by Richter, the aviator rests his elbows on the longitudinal members of the frame and controls the fore and aft attitude of the machine with an ordinary tail elevator operated by a short lever which is worked by a movement of the wrist. The machine is designed to be inherently stable laterally, and consequently no lateral controls are fitted. The aviator's own legs form the undercarriage of the machine.

Altogether Richter has made more than a thousand flights with his various types of gliders, and with those of other constructors. It is noteworthy that the very keenest interest is taken in Germany, where gliding competitions with quite a large number of entrants have taken place in the hills of the Rhon.

THE WINNER OF THE LONDON AERIAL DERBY

WE are indebted to our British contemporary, the *Aeroplane*, for the following facts concerning the "Mars I," which recently won the London aerial derby:

Designed by Mr. H. P. Follond, whose machines had the air almost to themselves on the day of the race, the "Mars I," as the machine is officially called, bears very obvious signs of its parentage, in that it is very largely constructed of components which form part of previous machines of his design.

The greater part of the fuselage, the undercarriage and the tail unit are constructed from the same component parts as are the same parts of the well-known "Nighthawk," and in external appearance at least are indistinguishable from those of the ancestral machine.

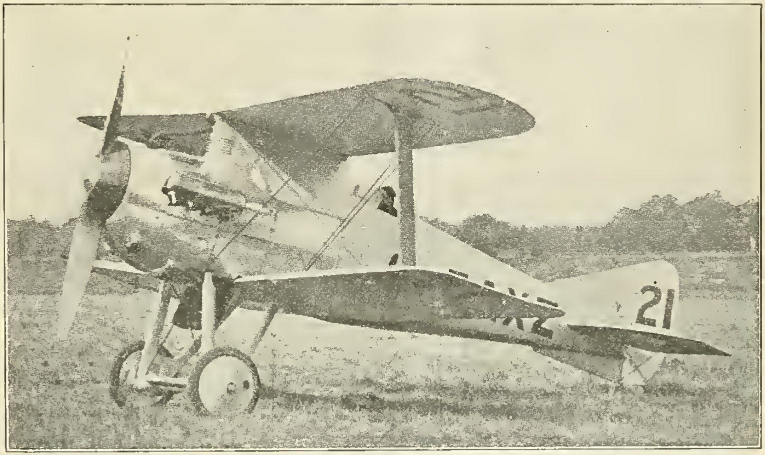
The fore end of the fuselage, instead of being provided with a steel plate serving as bearer for the radial engine of the "Nighthawk," is fitted with a multiple bulkhead supporting the engine bearers for the Napier "Lion" engine. These bearers are further supported forward by two more multiple bulkheads which are in turn supported from the after main bulkhead by a steel tube cantilever framework. The details of this mounting and the general scheme thereof are very clearly shown in certain of the photographs and sketches appended.

Immediately below the engine mounting and suspended from the two forward engine-bearer bulkheads is the oil tank, which forms at the bottom the outer surface of the complete fuselage, and is longitudinally corrugated to give ample oil cooling surface. Behind the oil tank, projecting down below the fuselage is the radiator, rectangular in elevation, and of the usual honeycomb type.

Mounted on the top of the fuselage and extending from just ahead of the back cylinders of the engine to the pilot's cockpit is a large structure, roughly triangular in front elevation, whose sides are tangent to the fuselage section and meet, or nearly meet, at the top plane. This structure is, in fact, the petrol and the water header tank, combined to act as a cabane for the upper plane.

The front end of this combined tank and cabane contains a water header tank, whose front, semi-cylindrical in form, is deeply corrugated to provide added cooling surface. The rear portion contains the petrol tank.

The advantages of this arrangement are several. In the first place it allows the simplest possible petrol system, as there is an ample gravity head to the carburetters. The pilot of a racing machine such as this has plenty of things to think about, and the complications and the risk of failure of pump or pressure-fed petrol are not desirable in such a case. Secondly, the total resistance of this solid cabane is probably no more, and may be less, than that of the equivalent four struts of usual practice. Thus the designer has been able to secure the advantages of gravity-feed petrol, together with an ample head of cooling water, without the added resistance of separate tanks outside the fuselage.



Mars I—Winner of the London Aerial Derby

The wing structure is very similar to that of Mr. Folland's previous racing machine, the "Goshawk." That is to say it is a slightly staggered biplane, equal both in chord and in span on top and bottom wings and fitted with one deep I-form strut on each side.

Top and bottom wings differ somewhat in plan form. The top wing, which has no ailerons, is rounded at front and back at the tips, the rounding being if anything more pronounced at the back. The bottom wing, which alone has ailerons, has its leading edge rounded off, much as has the top one, but has practically a square trailing tip.

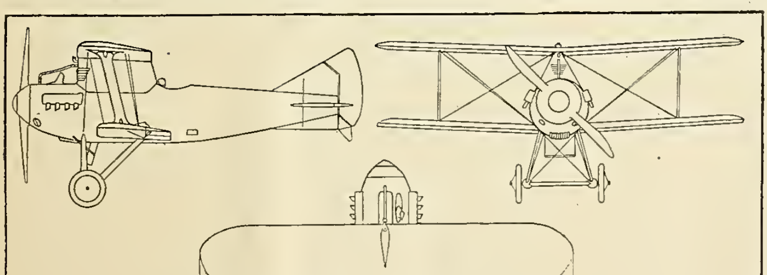
The wings proper are built in the usual way on front and rear spars. In section they are fairly thick, though of relatively small mean camber, the under surface being slightly convex downwards at the leading edge.

The wire bracing is somewhat unusual. The front spar is supported in flight by one single streamline wire on each side, running from the top of the forward undercarriage strut to the line of the interplane strut. Two such wires are carried from the top of the rear undercarriage strut to the top back spar. This duplication of the rear spar wiring only is entirely sound in a machine such as this designed solely for high speeds, for the machine will normally fly with the center of pressure far aft, and with a heavy load on the rear truss.

Only one landing wire is fitted on each side, this wire running from the top of the tank cabane to the front bottom wing spar. Thus the inherent stiffness of the wings and the interplane struts are relied on to take care of the landing loads on the rear spars. Considering the heavy loading for which the wings have been designed, and the relatively great depth available for spars, there can be little doubt that the structure is adequately stiff to meet these conditions and for speeds such as are expected of this machine, the suppression of two streamline wires on each side is an appreciable economy.

At their roots the two upper wing halves are bolted to a flange provided for the purpose on the "cabane tank." It has not yet been possible to discover how this "cabane tank" is fixed to the fuselage structure, but apart entirely from any such fixing, lift loads from the top wing roots are transmitted to the body by two pairs of cables—one from each front spar, which are attached to the two fittings to which the rear undercarriage struts are attached. The engine is extremely neatly cowled, in readily detached aluminum cowling, which, when in place, discloses only the heads of the two side cylinder blocks, and blends very smoothly into the nearly circular fuselage.

The outline of the body is completed by a large domed boss, built integrally with



the airscrew. and a small nose dome which covers the lock nuts and front flange of the engine hub.

The pilot's cockpit is immediately aft of the gasoline tank, and the pilot must be to some extent shielded from the air blast by its presence. It would at first sight appear that his view must be greatly obstructed by the presence of this erection, but it is in fact so narrow that he has an excellent view ahead on each side of the tanks. In all other directions the view is in no way modified by the peculiar construction.

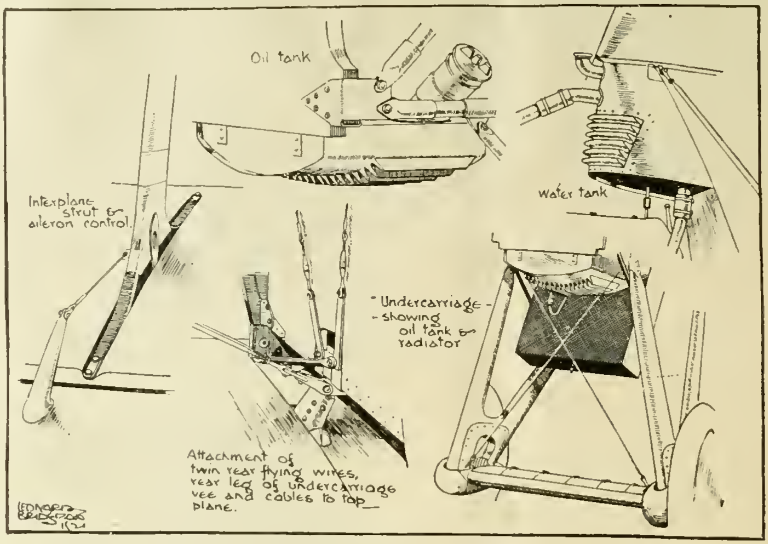
The general fuselage construction is, as has already been mentioned, similar to that of the "Nighthawk." That is to say that it is a conventional four-longeron, strutted, and swaged rod braced affair, tapering to a vertical knife edge at the stern, and faired out to an oval section by formers and laths.

The tail unit is, it is understood, identical with that of the "Nighthawk." There are fixed fins above and below the fuselage, the upper of about twice the area of the lower. These fins are followed by a "comma"-shaped rudder, slightly balanced at the top, and cut off at the bottom to accommodate the well-known steerable and streamline tailskid which was first used on S. E. 5's.

The tail plane is in no way abnormal, being of symmetrical streamline section nearly rectangular, but with the leading edge rounded in plan, and the elevators are of the usual divided type with very nearly square tips.

The undercarriage again is unaltered "Nighthawk." That is, it is generally of the standard vee-type, but each vee is a single unit, built up of plywood. These vees are united at the bottom by two steel tubes between which the undivided axle rides. Rubber shock absorbers allow the axle to move in the vertical slots at the base of the vees. These absorbers are themselves encased in an aluminum streamline casing.

A single set of streamline wire cross-bracing in the plane of the front legs of the vees completes the undercarriage structure.


Oil tank
Water tank
Interplane strut & aileron control.
"Undercarriage - showing oil tank & radiator"
Attachment of twin rear flying wires, rear leg of undercarriage vee and cables to top plane.

The machine is fitted with an airscrew designed specially for it by H. C. Watts. With the very little time which was available for tests of the machine before the race, it was impossible to allow for any trial and error work on airscrew, and it is very satisfactory to know that there was no need for it. The airscrew was satisfactory in every way and did all that was hoped of it.

As may be seen from the photographs, the machine is of very clean and graceful appearance, and it may be added that a close-up examination fails to show any detail which would evidence the extreme speed with which the machine was built.

It is understood that the machine will very shortly proceed to Martlesham to attack the existing speed records, and, although there may be some room for doubting whether the figure which now stands for the world's speed record will be passed, there is no likelihood that any machine now existing will be able to make a better speed on the same course.

The main particulars of the "Mars I" are given overleaf.

Specifications of the "Mars I"

Span	23 ft.
Chord	4 ft. 9 in.
Gap	4 ft. 9 in.
Stagger	1 ft. 4 in.
Total wing area	205 sq. ft.
Length over all	21 ft.
Engine	450-h.p. Napier
Fuel capacity	50 gal.
Oil capacity	5 gal.
Water capacity	7 gal.
Weight empty	1,890 lb. approx.
Weight loaded	2,500 lb.
Loading per sq. ft.	12.2 lb.
Weight per h.p.	5.5 lb.

THE PROBLEM OF FUEL FOR AVIATION ENGINES[1]

Technical Note of the National Advisory Committee for Aeronautics

THE speaker began by mentioning the physical properties which may be demanded of fuels for aviation use and the means that may be adopted by the engine manufacturers to properly meet the demands necessitated by the use of such fuel.

In the choice of a fuel the following factors must be considered: (1) its composition; (2) the quantity available; (3) the price per heat unit; and (4) the possibility of keeping stocks in aerial ports both at home and abroad. It is also important to know if the change from one fuel to another will necessitate any serious modification of the engine. With the present universal scarcity of gasoline, the day will certainly come when heavier fuel will have to be considered.

The storing of fuel in the aeroplane and supplying it to the engine are other points to be considered. Gaseous fuel, which would have to be taken on board in large gas bags or in air-tight cylinders, cannot be considered as the primary fuel on account of the space occupied by and the weight of such containers. At best it might be carried in liquid form in heat-proof containers. Solid fuels which might be pulverized or are in the form of powder (explosive material) cannot be considered, although liquefiable or soluble fuels such as naphthaline or paraffin might be used. Liquid fuels of high calorific value per unit of weight are best adapted to the purpose. Such fuels are the saturated and unsaturated hydrocarbons which not only have a high calorific value per unit weight but which may be easily supplied the engine in a very fluid state. Considering the fact that aeroplane engines must be capable of operation near the ground in the intense heat of summer and also at high altitudes in the severe cold of winter, the question of fuel supply is not of the simplest because many fuels lose their fluidity at extremely low temperatures. Special measures must therefore be taken so that at least the portion immediately required for the engine may be kept in a very fluid state either by heating with hot water, hot oil or electrical energy.

One of the most important points to be taken into consideration is that of ensuring the safety of the fuel from ignition in case of leaks in or injury to the tanks and connecting pipes such as may occur in forced landings. This brings out a property demanded of the fuel by the manufacturers of aeroplane engines, namely the possibility of quickly and easily supplying to the engine a good combustible mixture without the necessity for preparing such a mixture at a temperature or pressure other than that of the free air at the altitude at which the engine is operating. An ideal fuel would be of such a nature that it does not evaporate instantaneously in free air or at least does not form a mixture that ignites easily, but which can be mixed and gasified satisfactorily in the carburetor and will form a sufficiently inflammable mixture in the engine cylinder.

These conditions have not yet been fulfilled. Apart from insuring the safety of all the fuel pipes by double tubes and double jackets, they might be met satisfactorily in two ways. In the first of these use could be made of an explosive fuel that evaporates easily, such as gasoline or benzol, supplied in such a manner that there is no possibility of delivering fuel to the engine in excess of its instant requirements. For this purpose the fuel in the tank would have to be condensed to such an extent or kept at such a low temperature that it resembles an ointment in fluidity and will not flow out of a leaky tank or it might be absorbed by some special substance to prevent its escape. In the second way, fuels could be used that do not readily gasify, i.e., fuels with high boiling points and flash points. The carburetor would be so designed or the intake air and fuel would be brought to such a condition in the manifold or in the cylinder that mixing and ignition would be satisfactory. The important question of the utilization of fuels of lower inflammability and consequently of higher boiling point and lower cost would thus depend on the engine.

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[1] Lecture given by Professor Kutzbach, of Dresden, Scientific Collaborator of the Adlershof Aeronautical Laboratory.

The preparation of the fuel mixture in the carburetor was then discussed. The carburetor functions primarily as an ejector pump as shown in Fig. 1. The following equation (1) expresses its metering relations:

$$\frac{W_a}{W_f} = \frac{A_a}{A_f} \sqrt{\frac{D_a}{D_f} \quad \frac{P_a}{P_f}}$$

W_f and W_a signify the weight of the fuel and of the air respectively and should preferably be used as a clearly defined ratio, usually in aeroplane engines one giving a slight excess of air or of fuel; A_f and A_a the cross sectional areas of flow; D_f and D_a the densities of fuel and air at the mixing point; and P_f and P_a the pressure drops at the nozzles in millimeters of water. The air velocities are only indirectly stated in this equation in the value of D_a which falls very slowly with increasing values of r.p.m.

In changing from one fuel to another, the fuel nozzle A_f must be so altered that the new fuel requirement W_f of air shall be proportional to the square root of the density D_f. The ratio of the two areas would therefore be given by equation (2)

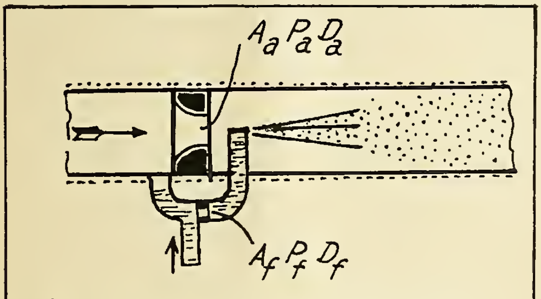

Fig. 1 Diagram of carburetor

$$\frac{A_f''}{A_f'} = \frac{W_f''}{W_f'} \sqrt{\frac{D_f'}{D_f''}} \qquad (2)$$

when W_f' or W_f'' represents the weight of completely burnt fuel in chemically combining proportions with unit weight of air.

We further see by equation (1) that the mixture ratio changes with change in altitude of flight as D_a diminishes as the altitude increases, while D_f remains unchanged in the case of liquid fuel. $\frac{W_a}{W_f}$ would therefore decrease as $\sqrt{D_a}$ with increased altitude, and the engine would therefore consume more and more fuel unless preventive measures were taken. The influence of temperature is likewise expressed in D_a so that the mixture would be richer in warm weather; that is, with reduced air density.

It is especially important that any possibility of separation of the fuel and air, either in the manifold or cylinder, should be prevented. There are two fundamental ways of doing this:

1. By the finest possible atomization, whatever the load and engine speed may be. This has been proved by experience to be accomplished by high air velocities and low fuel viscosities.[2] Atomization with slow engine speed may often be found difficult.

2. By vaporization of the whole or the main part of the fuel, so that there is no longer any possibility of its separation from the air.

There is no object to be gained, however, by the vaporization of the fuel before the fuel nozzle except in the case of liquids having a very low boiling point, such as liquefied illuminating gas, methane, etc. The boiling point of the ordinary engine fuels is too high at atmospheric pressure. (See Fig. 2). Fig. 2 gives distillation curves of pure and mixed fuels from various sources. At atmospheric pressure the boiling point is far higher than atmospheric air temperatures. When light gasoline is used, provision must be made for adequate cooling at high altitudes, as it would otherwise attain boiling point on acount of the low air pressure, thus deranging the formation of the mixture and causing the engine to stop working.[3]

For liquid fuel the vaporization therefore best takes place after leaving the fuel nozzle when it is surrounded by the air for combustion which must also supply the heat for evaporation.[4] As about 12½ m.³ (441 cu. ft.) of air combine with 1 kg. (2.2 lbs.) of gasoline or petroleum, the volume of the gasoline vapor is only about 1/50, and that of petroleum only 1/200 that of the air, so the partial pressure of the fuel vapor is therefore only 1/200 of the atmospheric pressure; and the process of evaporation takes place more easily than without such low partial pressures of fuel vapor.

The quantity of liquid fuel passed through the nozzle therefore evaporates extremely rapidly in the air in consequence of its low partial pressure,—the boiling point being considerably lower than with atmospheric pressure—and continues until the saturation point of the air is reached. The air is more or less saturated after the evaporation of the fuel, depending on the boiling points of the fuel, its vapor volume and the temperature of the air. The curves in Fig. 3 show that with hexane air is saturated at —18° when there is the quantity of hexane (the principal component of gasoline[5]) necessary for good combustion, so that when the air is cooled about 30°C by evaporation, air of about +15°C suffices to bring about complete vaporization.[6] The intake air at +15°C is at first entirely free from fuel; it then evaporates rapidly, cooling and increasing the fuel content of the air at the same time. At —15°C its percentage of saturation amounts to 85 per cent when the entire fuel needed for combustion has evaporated.

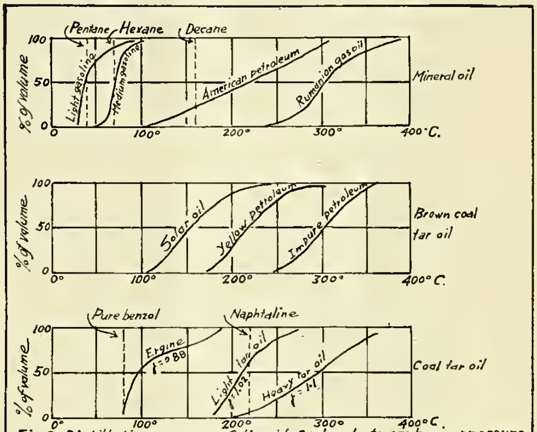

Fig. 2. Distillation curves of liquid fuels at atmospheric pressure

Similar values are given in Fig. 4 and in Table 1 for hexane, benzol, ethylalcohol, decane (a component part of petroleum) and naphthaline, the approximate boiling points at atmospheric pressure are also given.

Table 1

Fuel	*Boiling point*	*Saturation temperature of the fuel mixture*	*Drop in temperature due to evaporization*	*Temperature of the air for complete vaporization higher than*
Hexane	70°C	—18°C	30°C	15°C
Benzol	80°	— 5°	30°	30°
Ethyl Alcohol	78°	+22°	110°	135°
Decane	160°	+42°	35°	80°
Naphthaline	220°	+92°	40°	135°

In the case of alcohol, the cooling of the air is remarkably great, chiefly because of the small amount of air in the combustible mixture, and the high latent heat of vaporization which must be supplied by that small quantity of air. Only fuel mixtures with a temperature sufficiently higher than the saturation temperature can be entirely vaporized in the short time available and thus be insured against any separation of fuel and air. Below the saturation temperature, part of the fuel is always in the form of fog or small droplets, and the

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[2] See Note I.

[3] See Note II.

[4] See Note III.

[5] See Note V.

[6] See Note IV.

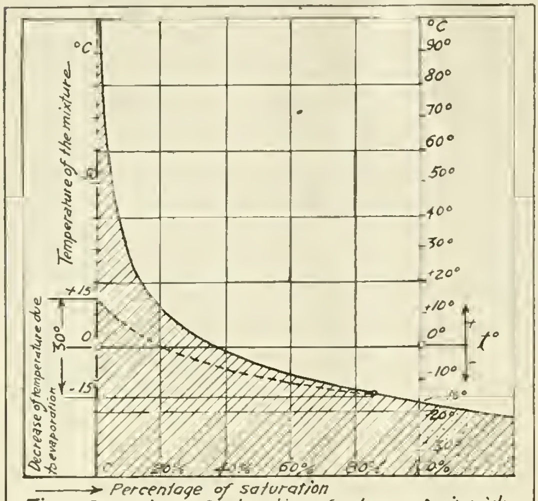

Fig. 3. Percentage of saturation of a hexane* air mixture at several temperatures.

larger the drops the greater is the possibility of the separation of the fuel.

If, however, all the walls of the pipes and of the combustion chamber be maintained at temperatures above that of saturation by the aid of the natural heat of the machine, of the heat of cooling water or of the exhaust, the risk of the separation of the mixture is sensibly diminished.[7]

There are two methods of using fuels with high boiling points, either or both of which may be applied separately or simultaneously: first, by atomizing the liquid as finely as possible at all loads; and second, by increasing the temperature of the fuel mixture and walls above the saturation temperature of the fuel-air mixture.

This increase in the temperature of the mixture and walls is difficult when starting the engine cold as it requires time to obtain heat from some source and transfer it to the mixture. The most convenient method is to start with fuel of a low boiling point and run until the desired temperatures are attained. There is one great disadvantage to be considered in the increase in temperature of the mixture, namely, the great difference in the heat supplied by the engine at different loads. In the case of the aeroplane engine, which is almost always fully loaded, this disadvantage is fortunately of no great importance.[8]

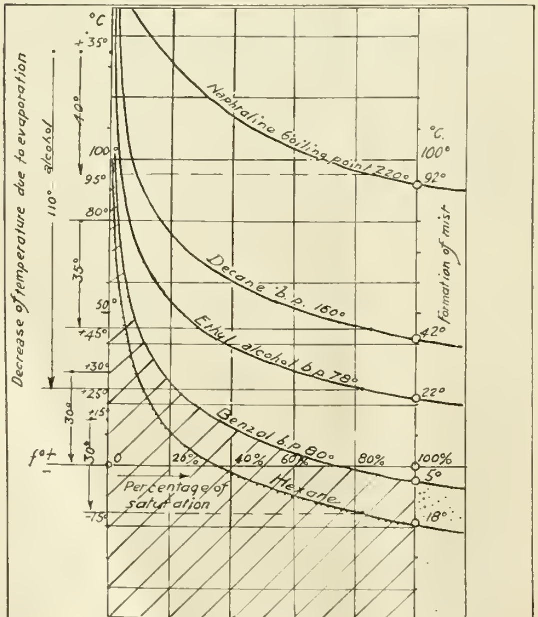

Fig. 4. Percentage of saturation at different temperatures for mixtures and several fuels'

The first consequence of the increased temperature of the mixture and walls is a reduction in volumetric efficiency, E_v and likewise of the mean effective pressure of the engine, due to the decreased density of the air. The following equation gives the mean pressure:

$$p_m = \frac{427 \, . \, E_t \, . \, H \, . \, E_v}{10000} \qquad (3)$$ [9]

in which E_t indicates the thermal efficiency, and H the heating value of a unit volume of the mixture. If the air be adequately heated so that the mixture enters the cylinder at its saturation temperature, an alcohol mixture would have to be 27° warmer than one of gasoline since the saturation temperature of the former is +22°C while that of the latter is —5°C. This increase in mixture temperature would result in a 10 per cent loss of air weight at full throttle. A naphthaline-air mixture at 92° would give a greater loss. In both cases there is a loss of intake oxygen, of E_v and consequently of power. The higher the saturation temperature of the mixture as for gas-oil and heavy tar oils, the higher the point to which the preliminary heating must be carried.

It would obviously be a good plan to transfer the process of mixing to the combustion chamber itself, in order to heat the walls of the combustion chamber and also the fresh air supply in the shortest possible time. This would, however, necessitate the rejection of the simple yet marvelously effective air ejector as an atomizing and mixing device, and its replacement by a compressed air atomizer or even by the simple spraying of the required amount of fuel by means of a special pump. The less effective the atomization the longer will be the time required for vaporization, and as vaporization must be finished before ignition begins, the unfavorable atomization must be compensated for by greatly increasing the temperature of the air.

This is particularly evident in the case of engines ignited by incandescence, the air into which the fuel is injected being heated to an unusually high temperature through the red-hot, or at least extremely hot, uncooled walls. It is certainly possible to utilize all kinds of fuel with a high boiling point in these engines, but there is a great disadvantage in the unfavorable cylinder efficiency and in the after-burning of the fuel, which is too slowly vaporized and poorly mixed. For these reasons, the solution offered cannot be considered satisfactory.

The lecturer went on to say that he had personally tested the possibility of utilizing fuel with a high boiling-point by means of injection into the combustion chamber with compressed air atomizers, and that such injection could be made at any moment desired. The results showed the operation of the engine to be least reliable when injection was completed just before the ignition, although the air in the engine was then at the highest temperature. The operation was satisfactory only when injection took place while air was being taken in, in which case the prolonged period of carburetion and the stronger air currents certainly caused favorable effects. (In the case of two-stroke engines, injection can take place only during the process of scavenging or compression). The compressed air can be used for atomization or the air can be supplied at a higher velocity, by Bellem and Bregeras' process,[10] by using a very much reduced pressure in the combustion chamber during a portion of the intake stroke. By these methods there are still various possibilities of rendering fuels with a high boiling point utilizable without the great disadvantage of a marked rise in temperature outside the combustion chamber itself.

The increase in the temperature of the mixture during the intake stroke entails another disadvantage besides the reduction of volumetric efficiency, namely, that of very considerably increasing the average temperature during the whole cycle, particularly the temperature during compression. This is a very great disadvantage as it increases the risk of premature ignition in the mixture.

With regard to premature ignition itself, too little is known about it at present to enable us to give a clear and unbiased judgment as to its cause. The results that have been obtained present many facts tending to general enlightenment, and the engine itself shows most readily how it is affected by fuels and temperature.

The influence of the initial temperature of the mixture on the maximum temperatures at the conclusion of compression is shown in Fig. 5. If the compression ratio is 1 : 5, the com-

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[7] See Note VIII.

[8] See Note IX.

[9] See Note X.

[10] See Buchner's Notes on the Benzol question; Fig. 39 in the "Automobile Rundschau" 1913, and Heller's Petroleum Driving Force in Automobiles, Z. d V. d. Ing. 1919, p. 778.

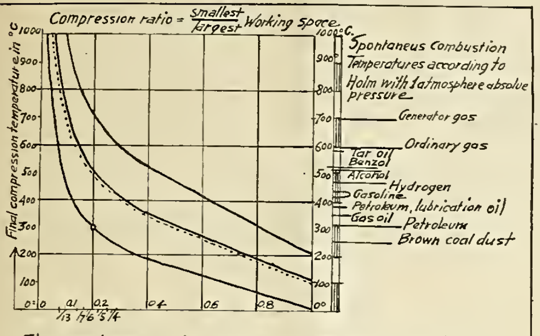

Fig. 5. Final compression temperatures with different initial temperatures and compression ratios (n = 1.4). On the right side the spontaneous ignition temperatures at atmospheric pressure according to Holm are given.

pression temperature amounts to about 300°C, 500°C or even 700°C with initial temperatures of 0°C, 100°C, or 200°C. Supposing the limit of admissible compression temperatures to be about 400°C, the compression ratio must be reduced in proportion to the increase in the initial temperature. Experience has shown, however, that totally different degrees of compression are necessary in one and the same engine for different fuel mixtures; that the shape of the combustion chamber, the temperatures of the badly cooled parts, such as the piston, the exhaust valves and the spark plug, and the freedom of the top of the piston from carbon deposit have marked effects. In conclusion, we may say that the risk of premature ignition decreases as the weight of charge is reduced, although the compression ratio which determines the temperature at ignition and the composition of the mixture are not thereby altered.

Tests so planned that liquid fuel was brought into contact with air in an electric furnace[11] in which the temperature could easily be regulated were carried out at the Augsburg Nuremburg Machine Fabrik by Dr. Holm at request of the lecturer. In Fig. 5 the spontaneous ignition temperatures found by means of this somewhat crude method are given. They enable us to draw comparisons and form conclusions with regard to the action of the fuels in engines. They confirm experience which shows that engines with benzol and alcohol are generally far less inclined to premature ignition than with gasoline.

They show also that petroleum and gas-oil, for which the temperature must be raised when they are utilized in the carburetor, possess particularly low spontaneous combustion temperatures, so that there are two reasons for using a low compression ratio with these fuels.

As the thermal efficiency decreases with reduction of the compression ratio, petroleum and gas-oil appear to be most unsuitable for use with a carburetor, and tar oil very well suited. Another difficulty arises through the fact that not only the principal fuel, but also the lubricating oil used may turn the scale in causing spontaneous ignition. Hopkinson[12] made a remarkable test with an engine using ordinary gas, in which he tried to bring about premature ignition with the aid of a red-hot plug, the temperature of which he measured with thermo-elements. It was not until the temperature of the plug was 600° to 700° that premature ignition took place. If a drop of lubricating oil fell on the plug or on the exhaust valve, a temperature of 400° sufficed for spontaneous ignition. The difficult question as to what part is played by lubricating oil in spontaneous ignition, reminding one of spontaneous ignition in air compressors, here plainly crops up again.

An essential provision for the safe operation of engines with prepared fuel mixtures ignited in the engine by means of a special ignition pin is that the compression temperature should remain far lower than that of spontaneous ignition under all conditions. By selecting suitable fuel and suitable lubricating oil, it is certain that several important economical advantages might be attained. The first step necessary would be the systematic investigation of the properties mentioned, namely, the boiling points, saturation and spontaneous ignition temperatures of fuels considered usable, and the effect of these characteristics on the performance of the fuel in the engine.

If, as in the case of gas oil and petroleum, the spontaneous ignition temperature is so low that the engine can probably not be operated economically on account of the low compression ratio, all that remains is to undertake the mixture of the fuel and air immediately before ignition, allowing the mixture to burn like the flame of a gas burner in the air, as was done by Oechelhauser in the case of ordinary gas engines. Diesel applied the process to petroleum and gas-oil. In this way all risk of advanced ignition is avoided, and it becomes possible to increase the degree of compression as desired, and thereby the thermal efficiency. These combustion engines, as the lecturer termed them, in contradiction to ignition engines fired by means of an electric spark, were so designed that the finely atomized incoming fuel meets with fresh air of a temperature far higher than its spontaneous combustion temperature and is, therefore, very rapidly vaporized and burned. The test data given by Holm in Fig. 5 explains the fact that to insure spontaneous ignition of tar oil, the fresh air must be hotter than is needed for gas oil. The combustion engine, however, has the peculiarity that it is impossible for the entire weight of fresh air to be used in the combustion in the short time available. It must, therefore, work with an excess of air, and consequently with lower mean effective pressure. This is occasioned by poor atomization (in engines ignited by incandescence it is usually particularly bad), by the incomplete utilization of the air, and by the increased ratio of piston velocity to ignition velocity.

The lecturer then alluded to the importance of the question of ignition velocity, which plays an important part in the case of high speed engines in particular, and which is as yet insufficiently understood. The well-known researches made at Dresden, by Nagel, Neumann and Nusselt, in burning cold mixtures in a bomb should be extended to as many different fuels as possible. Fig. 6 shows the ignition velocities of various fuel mixtures, set down in terms of the colorific values of the fuel contained in the cubic meter of the mixture, on the basis of Nagel and Neumann's measurements. The values are, like Holm s measurements, most instructive as comparative values. The ignition velocity of the hot mixture in the engine itself is far higher. The so-called limits of the ignition of different fuels (according to Eitner) are also given in Fig. 6. They accord fairly well with the ignition limits obtained in the bomb. The calorific values of mixture ratios giving rise to the greatest development of heat in the engine and to the maximum value for the formation of CO_2 are important. This thermal value varies from 700 to 900 gram calories per cubic meter (45 to 59 B.t.u. per cubic inch), according to the heating value and the amount of air required by the fuel; it is a decisive factor in determining the highest possible mean effective pressure (see equation 3) and consequently of the maximum power of an engine with the fuel in question. As the ratio of air to fuel increases, the ignition velocity first increases slowly, then, in the case of some few fuels, as for instance, ordinary gas, it increases rapidly; in other cases, especially with gasoline and benzol, it falls slowly. For the engine, however, the ignition velocity must not be too low, lest after-burning and delaying explosion take place; nor must it be too high, lest the rapid combustion give rise to too violent explosions. With increasing piston velocities, it must,

(*Continued on page 22*)

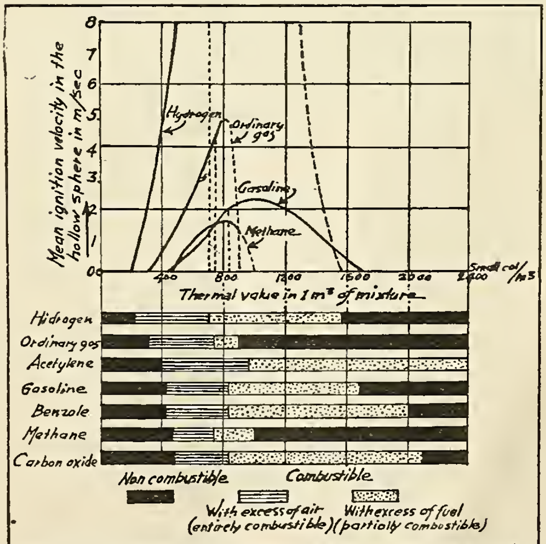

Fig. 6. Ignition limits and velocities of different fuel mixtures in a closed chamber (in terms of the thermal value of the fuel in 1 m³ of mixture).

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[11] See Dr. Holm's article in the "Zeitschrift f. angew. Chemie" (Journal of Applied Chemistry, 1913, p. 273.)

[12] See Proceedings of the Institution of Civil Engineers, 1909.

THE EMPLOYMENT OF AIRSHIPS FOR THE TRANSPORT OF PASSENGERS

Indications on the Maximum Limits of Their Useful Load, Distance Covered, Altitude and Speed*

By UMBERTO NOBILE

Director of Italian Aeronautical Construction

(Concluded from last issue)

10.—Maneuvering Devices

The total weight of these devices, and especially of the cables, evidently varies in proportion to $V^{4/3}$.

In point of fact, while the forces are proportional to V, the length of the cables is proportional to $V^{1/3}$.

In our case we have:

$$0.00060 \;.\; V^{4/3}$$

11.—Lighting Plant, Wireless Plant, Etc.

The equipment of the airship is completed by the lighting plant, wireless installation, ventilators, safety appliances, signals, and other minor accessories.

Of these weights some, such as that of the wireless installation, may be assumed to increase slightly with the cubature of the airship (in fact, it is probable that a wider range of wireless will be required for larger airships). Other accessories, such as the lighting plant, increase in proportion to $V^{2/3}$; others, as the ventilators and safety appliances, increase in the same ratio as the cubature.

In the case of our model we have:

$$4.5\ V^{1/3} + 0.19\ V^{2/3} + 0.007\ V$$

12.—Pilot's Cabin

The pilot's cabin is provided with all the instruments required for navigation and with other necessary equipment.

It is difficult to give a definite ratio of the variation of the weight with the cubature.

To simplify matters we will assume that the area of the cabin is proportional to $V^{1/3}$ and that the total load also increases in proportion to $V^{1/3}$. We then conclude that the total weight varies in proportion to $V^{2/3}$. In our case: $0.300\ V^{2/3}$.

13.—Passenger Cabins

It is not possible to determine a priori the weight of the passenger cabins and their equipment, since this must evidently be proportional to the number of passengers carried. We can, however, include this weight in the useful load by adding 20 to 25 kg. per passenger.

14.—Benzine, Oil, and Water Tanks

The weight of these tanks, comprising their supports, amounts to about 6% of the weight of the liquid contained therein.

The weight of the water tanks can be counted in with the weight of the ballast, and we will reckon the weight of the benzine and oil tanks by adding 6% to the weight of the benzine and oil needed per kilometer.

We have now evaluated the entire weight of the airship itself. In order to consider the airship in flying shape, we must add the weight of the crew, spare parts, reserve ballast, ballast needed for take off, and the weight of fuel and oil.

15.—The Crew

The number of men forming the crew depends not only on the cubature of the airship, but also on other circumstances which are not possible to account for a priori, and we will therefore be satisfied with a rough approximation.

The minimum crew needed consists of:

1 Commander 1 Mechanic
1 Pilot 1 Wireless operator.

With increased cubature of the airship, we may, generally speaking, assume that the journeys undertaken will be longer and more fatiguing, and that, therefore, double shifts will have to be provided for.

We are, therefore, justified in assuming that the weight of a minimum personnel will be in proportion to $V^{1/3}$.

The total number of mechanics, less the one included in the minimum crew, may be roughly considered as proportional to the power, that is, to $V^{2/3}v^{3}$.

There are also the all-around men who, though not required on a small airship, are certainly indispensable on a large one. The weight of these may be taken as proportional to the cubature of the airship.

In the case of our model, including also the weight of clothes and food reserves, we have:

$$20\,V^{1/3} + 10^{-6} \;.\; 0.20 \;.\; V^{2/3}v^{3} + 0.003 \;.\; V$$

16.—Spare Parts for the Engine Set and Tools

This weight may be taken as proportional to the engine power. In our case it is given by:

$$10^{-6} \;.\; 0.16 \;.\; V^{2/3}v^{3}$$

17.—Reserve Ballast and Take Off Ballast

As we said at the beginning, we shall suppose that navigation is normally started at an altitude of about 300 m. above sea level. The corresponding lightening of the airship will be approximately given by 0.030 V.

The reserve ballast may also be taken as proportional to the cubature and we may say that its weight in kg. is numerically expressed by 4% of the volume expressed in cubic meters.

The total weight of the ballast is thus expressed by:

$$0.030\ V + 0.040\ V = 0.070\ V$$

18.—Reserve Stock of Fuel and Oil

It is logical, we believe, that, in order to ensure safe navigation, the reserve stock of fuel and oil carried must be large enough to meet all eventualities. This reserve must be in proportion to the amount required for normal navigation. We will calculate this by increasing by 30% the usual consumption per kilometer, or, which amounts to the same thing, the specific consumption per h.p.

19.—General Formula for the Useful Lifting Force

Establishing, as we did at the beginning, the approximate laws governing the variation in the weights of the airship, the armament, and the crew, we find that the total weight, P, of the airship ready for navigation (except the passenger cabins, the benzine and oil tanks, and the reserve stock of benzine and oil) is expressed in function of the cubature and of the velocity by six terms respectively proportional to

$$V^{1/3},\ V^{2/3},\ v^{3}V^{2/3},\ V,\ V^{2}V,\ V^{4/3}$$

In Table I (see at the end of this paper) the numerical coefficients of these terms are summarized, and from that table we derive the following expression for P:

$$(2)\quad P = 24.5\ V^{1/3} + (3.274 + 10^{-6}\ 3.51\ v^{3})\ V^{2/3} + \\ + (0.160 + 10^{-6}\ 3.1\ v^{2})\ V + 0.0067\ V^{4/3}$$

in which V is expressed in cubic meters, v in km/h and P in kg.

V is the maximum effective volume of the gas bag after inflation.

If we subtract the weight P from the total lifting force at the sea level, f V*, we shall obtain the lifting force of which we can dispose for the useful load and for the provision of benzine and oil needed for navigation. We will call this the USEFUL lifting force and will represent it by Φ.

We should recall once more:

1st. That the useful load comprises not only the weight of the passengers, their baggage and food supplies, but also the weight of the cabins suitably fitted up for the number of passengers that can be carried.

2nd. That in the provision of benzine and oil is included not only that required for normal navigation, but also a proper quantity of reserve stock together with the tanks required for holding the entire provision.

Putting formula (2) in the general form:

$$(2^{1})\quad P = \alpha V^{1/3} + \beta V^{2/3} + \gamma V \div \delta V^{4/3}$$

we obtain for Φ

$$(3)\quad \Phi = f\,V - (\alpha\ V^{1/3} + \beta\ V^{2/3} + \gamma\ V + \delta\ V^{4/3})$$

This formula shows that there are two values of V for which $\Phi = O$, one very small, the other very large. Passing from the first to the second value, the useful lifting force first increases, then, after reaching a maximum value, decreases until it again equals zero.

The value of V, which corresponds to Φ maximum is obtained by extracting the value of V from furmula (3) and making it equal to zero:

$$(4)\quad f\,V = \tfrac{1}{3}\ \alpha V^{1/3} + \tfrac{2}{3}\ \beta V^{2/3} + \gamma V + {}^{4}/_{3}\ \delta V^{4/3}$$

20.—Variations of the Coefficient of Utilization in Function of the Cubature and Velocity. Limit Regimes of Flight

We will call "Coefficient of Utilization" the ratio ρ between the useful lifting force and the total lifting force:

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*In our calculations for f we shall assume the mean value of 1100 kg. per cubic meter of gas.

$$(5)\quad \rho = \frac{\Phi}{f\,V} = 1 - \frac{1}{f}\left(\alpha V^{-2/3} + \beta V^{-1/3} + \gamma + \delta V^{1/3}\right)$$

Here also, starting from a minimum value of V, for which $\rho = 0$, the value of ρ increases rapidly with the increase of cubature until it reaches a maximum. After reaching this maximum, the value of ρ decreases slowly down to zero again for a rather large value of V.

The values of V for which $\rho = 0$ (lower and upper limits of cubature) are obtained from the following equation:

$$(6)\quad f\,V = \alpha V^{1/3} + \beta V^{2/3} + \gamma V + \delta V^{4/3}$$

and, of course, the lower limit is higher as the velocity is lower. In fact, in this case the coefficients β and γ are small also, and we have:

$$\beta = \beta' + \beta''\,v^3$$
$$\gamma = \gamma' + \gamma''\,v^2$$

In the case of our model we find for these lower limits of V the following values*:

at 90 km/h $V = \backsim$ 1,000
at 120 km/h $V = \backsim$ 2,300
at 150 km/h $V = \backsim$ 13,000

The maximum value of β is found by the following equation:

$$\delta V^{4/3} = 2\,\alpha V^{1/3} + V^{2/3}$$

from which, neglecting the first term of the second member, we obtain as a rough approximation:

$$V^{2/3} = \backsim \frac{\delta}{\beta} = \frac{\beta' + \beta'' v^3}{\delta}$$

We may therefore conclude that *with increase of velocity maximum diminishes and tends towards larger cubature.*

As a matter of fact, in our case we find the following values (see Tables II, III, IV, and diagrams):

at 90 km/h max. = 0.450 for V = 35,000 m.^{3}
at 120 km/h max. = 0.345 for V = 60,000 m.^{3}
at 150 km/h max. = 0.202 for V = 125,000 m.^{3}

We would remark here that, contrary to the current opinion, the maximum values of the coefficient of utilization are to be found for relatively small cubatures.

The upper limit regime of flight to which the airship can steadily lift itself (assuming that there is no change in equilibrium between the internal and external temperature) is that for which the corresponding value of the air density is in the same ratio to the density of the air at sea level as P to f V. This limit thus depends essentially on the value of ρ.

Considering the mean conditions of temperature and atmospheric pressure, and assuming a constant difference of temperature of 0.0055 centigrades per meter, we find the following values which have been computed taking into account also the first 300 meters elevation:

for $\rho = 0.20$ H max. = 2430 m. above sea level.
for $\rho = 0.25$ H max. = 3050 m. above sea level.
for $\rho = 0.30$ H max. = 3700 m. above sea level.
for $\rho = 0.35$ H max. = 4380 m. above sea level.
for $\rho = 0.40$ H max. = 5120 m. above sea level.
for $\rho = 0.45$ H max. = 5870 m. above sea level.
for $\rho = 0.55$ H max. = 6700 m. above sea level.

and in the case of our model, corresponding to the values of ρ max. given above, we find:

at 90 km/h V = 35,000 H max. = 5870 m.
at 120 km/h V = 60,000 H max. = 4260 m.
at 150 km/h V = 125,000 H max. = 2450 m.

21.—Optimum Cubature. Consumption Per Kilometer

For the balloon the optimum cubature is evidently given by the maximum value of the coefficient of utilization.

As a matter of fact, for ρ max. the useful load is raised to a given height which is maximum, and the altitude to which a given useful load can be raised is also maximum.

But in the case of an airship it is evident that we must take into account the maximum distance over which a given useful load can be carried.

If we call p_u the lifting force per cubic meter required for the useful load, and c the supply of benzine and oil required per kilometer, we shall be able to measure the *unit velocity* of the airship by:

$$\epsilon = \frac{f\rho - p_u}{c}$$

which represents the maximum distance L over which the load p_u can be carried.

As we must first establish a value of p, we will take that which gives the maximum value of L x p_u. This maximum is evidently obtained when the useful lifting force, $\rho\,f$, is equally distributed between the useful load and the supply of fuel and oil. We will therefore assume as the ratio of the unit efficiency of the airship, the value:

$$(7)\quad \epsilon = 0.55\,\frac{\rho}{c}$$

We will now determine the value of c in the hypothesis that *the normal velocity of navigation, v_o, is obtained by utilizing half of the available power,* that is:

$$N_o = \frac{1}{2}\,\frac{k}{\pi}\,V^{2/3}v^3$$

We shall then have:

$$v_o = 0.794\,v$$

and therefore:

$$\frac{N_o}{v_o} = \frac{k}{\eta}\,\frac{V^{2/3}v^2}{1.588}$$

We will assume that the engine plant consumes about 250 grs. of benzine and oil per h.p./h. In order to calculate the total supply of benzine and oil needed, we will add 30% to the normal consumption, and in order to calculate the total weight we must also take into account the weights of the containers which we have evaluated at 6% of the total weight of fuel and oil. We shall then have per h.p./h. a weight of

$$(0.250 + 0.075) \times 1.06 = 0.345 \text{ kg.}$$

and therefore the total weight per kilometer will be given by:

$$c = 0.345\,\frac{N_o}{v_o}$$

and assuming for $\frac{k}{\pi}$ the value 10^{-6} 1.5 we obtain:

$$(8)\quad c = 10^{-9} \times 326 \times V^{2/3}v^2$$

and substituting in the expression of ϵ:

$$(9)\quad \epsilon = \frac{10^9}{593}\,.\,\frac{\rho}{V^{2/3}v^2} = a\,\frac{\rho}{V^{2/3}v^2}$$

The *optimum cubature* is that for which ϵ assumes its maximum value. It is obtained by solving the following equation:

$$(10)\quad 2\,(f - \gamma)\,V = 4\,\alpha V^{1/3} + 3\,\beta V^{2/3} + \delta V^{4/3}$$

We should not be surprised that we find some very low values. In fact it is evident that the optimum cubature must always be less than the one corresponding to the maximum value of ρ, because for larger cubatures the denominator of ϵ increases, while the numerator decreases.

In our case we find:

for 90 kw/h. : optimum cubature $= \backsim$ 5,000
for 120 km/h. : optimum cubature $= \backsim$ 10,000
for 150 km/h. : optimum cubature $= \backsim$ 30,000

If we now consider the velocity only as variable, it is obvious that efficiency diminishes with the increase of velocity. that is, there does not exist an *optimum value af velocity* outside of zero for which efficiency becomes maximum. And in fact if in $\frac{o}{V^{2/3}\,v^3}$ we express the coefficients β and γ in function of the velocity:

$$\beta = \beta' + \beta''\,v^3 = 3.274 + 10^{-6}\,3.51\,v^3$$
$$\gamma = \gamma' + \gamma''\,v^2 = 0.160 + 10^{-6}\,3.10\,v^2$$

and then make:

$$\frac{d}{dv}\left(\frac{\rho}{V^{-2/3}\,v^3}\right) = 0$$

we find:

$$v^3 = -\,\frac{(f - \gamma')\,V^{1/3} - \alpha V^{-1/3} - \delta V^{2/3} - \beta'}{2\,\beta''}$$

which, for greater clearness, we may write:

$$v^3 = -\,\frac{f\,V - (\alpha V^{1/3} + \beta' V^{2/3} + \gamma' V + \delta V^{4/3}}{2\,.\,\beta''\,V^{2/3}}$$

from which we see that the existence of an optimum value of the velocity difference from zero is contingent on the condition:

$$f\,V < \alpha V^{1/3} + \beta' V^{2/3} + \gamma' V + \delta V^{4/3}$$

which can never be attained because we should also have:

$$f\,V < P$$

22.—Cubature of Minimum Consumption. Distance Limits

When we come to consider the efficiency of the airship solely from a mechanical point of view, we find that for each velocity there is a certain cubature which permits of carrying the unit of useful weight to the unit of distance with a minimum expenditure of energy, that is, with a minimum consumption of fuel.

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*Regarding the possibility of practically realizing these minimum values of cubature, the reservations and observations made at the beginning of this study apply here also.

Let P_u be the maximum useful load which an airship can carry to a distance L. The consumption of fuel per kilogrammeter will be given by:

$$\frac{c\,L}{P_u L} = \frac{c}{P_u}$$

We will assume, as before, that the useful lifting force is equally distributed between the useful load and the supply of fuel and oil in such a way as to give $P_u L$ its maximum value.

In such a case the consumption per kgm. will be proportional to:

$$\frac{c}{\Phi}$$

that is, in inverse proportion to the maximum distance which the airship can cover without any useful load. We will call this distance the *"limit distance."*

It is evident that there exists a value of V for which the unit consumption is minimum and therefore the distance limit is maximum. In fact, we have only to consider that if the cubature increases indefinitely, the useful lifting force will finally reach zero, while c always has a positive value.

We will determine the value of this *cubature of minimum consumption,* which we may also call the *cubature of maximum range.*

Keeping in mind formulas (3) and (8) we can put:

$$(11)\qquad L_{max.} = \frac{\Phi}{c}\;\frac{f\,V - (\alpha V^{1/3} + \beta V^{2/3} + \gamma V + \delta V^{4/3})}{10^{-9}\;.\;326\;.\;V^{2/3} v^2}$$

Solving this equation for the volume and taking it as equal to zero we find:

$$(12)\qquad f\,V + \alpha\,V^{1/3} - \gamma\,V - 2\;\delta\,V^{4/3} = 0$$

an equation which, solved for V, gives the value of the cubature of minimum consumption.

This value being very high, the terms $\alpha\,V^{1/3}$ may be considered as negligible, and then we have only:

$$(13)\qquad V = \sqrt[3]{\frac{f-\gamma}{2\,\delta}}$$

a result which may be enuciated thus: *The linear dimensions of the airship of minimum consumption vary linearly with the coefficient γ and therefore with the square of the velocity and increase as the velocity diminishes.*

In point of fact, having, for our model:

for 90 km/h $f-\gamma = 0.915$
for 120 km/h $f-\gamma = 0.896$
for 150 km/h $f-\gamma = 0.870$

and $2\,\delta = 0.0134$, we find:

for 90 km/h : cubature of min. cons. = ∽ 318000m³
for 120 km/h : cubature of min. cons. = ∽ 299000m³
for 150 km/h : cubature of min. cons. = ∽ 274000m³

23.—Limit Velocity

For each cubatnre, the airship is designed for reaching a certain maximum velocity which cannot be exceeded. This limit vaule is at once obtained by solving for w the equation: $P = f\,V$.

Taking as a basis the expressions of P given by formula (2) we find, for our model, the following values:

$V =$ 1,000 m³ Velocity limit = 92.5 km/h
$V =$ 5,000 m³ Velocity limit = 133 km/h
$V =$ 10,000 m³ Velocity limit = 148 km/h
$V =$ 50,000 m³ Velocity limit = 173 km/h
$V =$ 100,000 m³ Velocity limit = 181 km/h
$V =$ 300,000 m³ Velocity limit = 185 km/h
$V =$ 300,000 m³ Velocity limit = 185 km/h
$V =$ 400,000 m³ Velocity limit = 178 km/h

As we see, the limit velocity first increases rapidly with the increase of cubature, then, after reaching a maximum of 185 km/h. for a cubature of from 200,000 to 300,000 cubic meters, slowly decreases.

In practice, of course, these values of absolute maximum of velocity should not be reached; in fact, they should not even be approached.

24.—Influence of the Coefficient of Resistance and of Propeller Efficiency

In the general expression of P given in formula (2′) the only term which depends on the power, and therefore on the coefficient of resistance k as well as on the propeller efficiency η, is

$$\beta\,V^{2/3} = (\beta' + \beta''\,v^3)\;V^{2/3}$$

β being proportional to N and consequently also to $\frac{k}{\eta}$.

It is therefore easy to see the effects produced by a variation of the ratio $\frac{k}{\eta}$.

As regards the coefficient of utilization ρ, of course it increases as $\frac{k}{\eta}$ diminishes and vice versa. More exactly, we may say that, for a given cubature, the variation follows a linear law, as is shown by the general expression for ρ. We may add that the variation is more rapid for small cubatures, for which the term $\beta\;V^{2/3}$ acquires greater importance with respect to the other terms.

The approximate expression $V^{2/3} = \frac{\beta}{\delta}$ which gives the cubature corresponding to ρ maximum, thus shows that with increase of $\frac{k}{\eta}$, ρ maximum is obtained for a larger cubature, and when $\frac{k}{\eta}$ decreases, ρ maximum tends towards a smaller cubature.

The *cubature of minimum consumption or maximum range* remains unchanged. This is clearly shown by formula (13) in which V is independent of β.

On the other hand, we have notable variations in the distance limit given by formula (11). Indicating by A a numerical coefficient, this may be put in the following form:

$$L_{max} = \frac{f\,V - (\alpha\,V^{1/3} + \beta\,V^{2/3} + \gamma\,V + \delta\,V^{4/3})}{A\,\frac{k}{\eta}\,V^{2/3}\;.\;v^3}$$

and from this it clearly results that when $\frac{k}{\eta}$ increases, the numerator decreases and, at the same time, the denominator increases, and therefore L_{max} decreases. On the other hand, when $\frac{k}{\eta}$ decreases, the numerator increases and the denominator decreases, that is to say, L_{max} increases.

Finally, the limit velocity also varies with $\frac{k}{\eta}$, increasing as $\frac{k}{\eta}$ decreases.

25.—Variations of the Limits of Distance and Velocity for Small Variations of Volume

In order to show more clearly the influence of the increase of velocity and range on the cost of operation of aerial transport, we will consider a difference in volume sufficiently small to enable us to assume that for all intermediate cubatures the coefficient of utilization, ρ, remains just about constant. This we can always do, even for rather large differences in volume, when, for instance, we consider the region of the maximum value of ρ.

The distance limit, in the above hypothesis is given by:

$$L_{max} = \frac{\rho\,V}{A\,\frac{k}{\eta}\,V^{2/3}\,v^2} = \frac{\rho\,V^{1/3}}{A\,v^2}\;\frac{\eta}{k}$$

and therefore

$$(14)\qquad V = \frac{A\,k}{\rho\,\eta}\;v^6\;L^3_{max}$$

from which we may conclude that for small variations in volume, the volume is proportional to the cube of the ratio $\frac{k}{\eta}$, to the sixth power of the velocity and to the cube of the distance. This last result may also be enunciated in a suggestive form as follows: *The length of the airship is proportional to the maximum distance that it can cover.*

Thus, for instance, in order to increase the distance limit by only 10%, we must increase the volume by 33%, and if we wish to increase the velocity by only 5%, the cubature must be increased by 35%.

Of course the results are even more unfavorable if, in the differences of volume considered, the value of ρ decreases, as is the case when this difference is on the right hand side of the cubature for which ρ is maximum.

(To be continued)

NAVAL *and* MILITARY AERONAUTICS

Navy Blimp Destroyed

Twenty minutes before she was to have started for the hangar at Lakehurst, N. J., the naval balloon D-6, the largest and newest non-rigid dirigible possessed by the navy, burned, with her hangar and three other balloons, at the Rockaway Point Naval Air Station August 31.

No lives were lost, but Machinist's Mate Donald B. MacKay, in the car when the fire started, was severely burned.

The D-6 was fully inflated and contained about 190,000 cubic feet of hydrogen gas. The other balloons, not inflated, were the kite balloon A-P and two small dirigibles, the C-10 and the H-1.

A board of investigation was immediately appointed by Commander F. H. Strong, and after a three-hour conference, in which all members of the crew of the D-6 were questioned, a report was forwarded to Admiral Moffett, in charge of the Bureau of Naval Aviation in Washington. Commander Strong would not make public the results of the investigation.

It was thought that gasoline fumes from a leaky fuel pipe may have been ignited by a spark from a hammer. A new tank had been installed and mechanics were busy connecting up the feed pipe.

Lieutenant Charles E. Bausch, who was to command the crew of seven men, had just ordered them to get their luggage when he saw flames shooting toward the gas bag. He ordered every man out of the hangar and turned in an alarm which brought all of the 250 men at the station.

The reserve hydrogen tank, containing about 50,000 cubic feet of gas, a steel structure of the cylindrical type, standing 100 feet from the hangar, was used as a vantage point from which the sailors turned streams on the burning hangar and nearby buildings, keeping the sides and top of the tank under two streams of water. Lieutenant Kloor and Commander Strong led the sailors. Their forces were supplemented by fire companies from the Rockaway Park station, and soldiers hurried over from Fort Tilden.

The combined forces kept a water barrage going for more than an hour on all sides of the burning hangar. A stiff breeze was blowing off shore and threatened for a time to carry the fire to the barracks, the Naval Hospital and storehouses and across the dry grass to cottages along the shore.

The D-6 was 200 feet long and fifty feet in diameter fully inflated. She was propelled by two 125-horsepower Union type motors, and could make fifty-five miles an hour. She had a lifting power of about ten tons. The D-6 carried 200 gallons of gasoline and had a cruising radius of 1,000 miles. She was assembled at the Rockaway Point Station under the direction of Lieutenant Bausch.

The gondola and engines were built at the League Island Navy Yard in Philadelphia and the balloon was made at the navy balloon plant in Akron, Ohio. The D-6 was equipped with the limousine type of gondola, completely enclosed, which made it possible, the authorities believe, for the men in the hangar to escape before the balloon ignited. The trip to Lakehurst would have been her maiden voyage, although she had been taken for several short test spins over Jamaica Bay and Coney Island.

The Navy Department has under way plans for several other ships of the D-6 type.

Aerial Planes to be Used in Alabama Attack

New weapons of aerial warfare will be given an initial test when the army air service conducts its next bombing operation—a night attack on the old battleship Alabama. The plan is to stage the attack about September 15, probably at the scene of the recent tests upon the former German craft, off the Virginia Capes.

A "light barrage," composed of giant aerial flares, each of more than 200,000 candle power, will be one feature of the attack. Army engineers have submitted such enthusiastic reports on this weapon that larger flares, estimated to be equal to 1,000,000 candles, have been placed under construction.

Giving a greenish-white light, literally "brighter than day," the flares to be used in the Alabama test will illuminate an area of five square miles and, expert flyers say, should enable the aviators to obtain greater accuracy than in the daytime. The flares are attached to a parachute of white silk, which reflects the light downward with sufficient intensity, it is believed, to blind the officers and gunners on the ship under attack, so as to demoralize any plan for defense, while keeping the upper air reaches shrouded in gloom.

Just before the armistice was signed flares of 200,000 candle power were perfected by the ordnance branch of the Army Air Service. They were equipped with eighteen-foot parachutes, which kept them aloft while the magnesium burned for a period of from seven to eleven minutes. No opportunity was afforded for a test against the enemy, however.

Although disappointed that they cannot have the Alabama equipped for battle with radio control, as they hoped, the army flyers are exerting every effort to conduct the bombing tests with war conditions as nearly simulated as possible.

It will not be the object of the army pilots to see how quickly they can sink the Alabama, but rather to try out special gas and non-extinguishable phosphorous bombs on her, as well as to ascertain the effect of small demolition bombs. Bombs up to 4,000 pounds each may be used.

The Alabama is at Philadelphia and practically ready for delivery to the air service.

Personal Paragraphs

Lt. L. W. Miller has been appointed Assistant Commandant and Officer in Charge of Training of the Photographic School at Langley Field, relieving Lt. James P. Hodges.

Captain Hal. T. Vigor, Q. M. C., has reported for duty at Langley Field, having been assigned to duty as Quartermaster. Lt. Glenn D. Gorton has been detailed as assistant to the Quartermaster.

Changes in Station of Air Service Officers

1st Lieut. Wm. J. Flood has been relieved from duty at Ross Field, Arcadia, California, and assigned for duty with the 8th Airship Company at Camp Bierne, Texas.

Lieut.-Colonel C. C. Culver has been assigned as student officer at the General Staff College for the 1921-1922 course.

1st Lieut. George E. Hodge has been relieved from duty at Fort Sam Houston, Texas, and assigned to duty in the Office of the Chief of Air Service, Washington, D. C.

Captain Arthur R. Brooks relieved from duty at Ellington Field, Texas, and assigned to Langley Field, Va., for duty.

1st Lieut. Clayton C. Shangraw relieved from duty at Bolling Field and ordered to Carlstrom Field, Arcadia, Fla., for duty and pilot training.

Captain Benjamin G. Giles relieved from duty at Post Field, Fort Sill, Okla., and assigned to Carlstrom Field, Arcadia, Fla., for duty and pilot training.

Major Leo A. Walton, Air Service, relieved from duty at the Field Officers' School at Langley Field, Va., and ordered to Washington, D. C., for duty in the Office of the Chief of Air Service.

1st Lieut. F. P. Kenney transferred from the Montgomery Air Intermediate Depot at Fairfield Air Intermediate Depot, Fairfield, Ohio, for duty.

1st Lieut. Wm. C. Sinclair, Infantry, detailed to the Air Service, and ordered to proceed from Camp Sherman, Ohio, to Carlstrom Field, Arcadia, Fla., for duty and pilot training.

1st Lieut. Earl J. Carpenter, Air Service, relieved from duty at Middletown Air Intermediate Depot and assigned to duty at Bolling Field, Anacostia, D. C., for duty.

1st Lieut. John E. Lynch, Air Service, relieved from duty at Kelly Field, San Antonio, Texas, and ordered to proceed to Washington, D. C., for duty in the Office of the Chief of Air Service.

Captain Horace N. Heisen relieved from duty in the Office of the Chief of Air Service, Washington, D. C., and directed to proceed to Langley Field, Va., as student officer at the Field Officers' School.

1st Lieutenants Frank M. Bartlett, Alonzo M. Drake and Clarence E. Crumrine have been relieved from duty in the Office of the Chief of Air Service, Washington, D. C., the first named to proceed to Chanute Field, Rantoul, Ill., for duty and the two last named to Mitchel Field, L. I., New York, for duty.

Major Maxwell Kirby has been relieved from duty in the Office of the Chief of Air Service and assigned as Corps Area Officer at Fort Benjamin Harrison, Indiana.

1st Lieut. Phillip Schneeberger relieved from duty in the Office of the Chief of Air Service and upon completion of leave of absence granted him will proceed to McCook Field, Dayton, Ohio, for duty.

FOREIGN NEWS

New South American Altitude Mark

Eduardo Olivero, an Argentine airman, who served in the Italian Army during the war, where he attained the rank of Captain and won five medals, has just set a new South American flying record for altitude by attaining a height of 26,240 feet. He may have gone higher, for 8,000 meters was the most the instrument would register, and Olivero lost consciousness for some time on reaching this height. The record height was reached in one hour and fifteen minutes. The flight was made in exceptionally cold weather.

Aeroplanes and the Canadian Oil Fields

The Imperial Oil Company of Canada has adopted up-to-date methods in "beating others to it" to the oil fields in the vicinity of Fort Norman. A party of four, consisting of the pilot, mechanic, a surveyor and a geologist, flying over miles upon miles of untenanted and practically unexplored sub-arctic lands, recently made a journey in a JL-6 all-metal aeroplane owned by this company from Peace River, Alberta, to Fort Norman, Mackenzie River District, N. W. T., a distance of approximately 1,400 miles by river and lake, in 13 hours and 40 minutes actual flying time. The machine flew on the average around 80 miles an hour, although on occasions with wind on her tail it made bursts of speed reaching to 100 miles per hour. When the aircraft began approaching the foothills of the Rocky Mountains, which run down to the Mackenzie River at the mouth of the Nehami, the scenery from aloft was impressive beyond description. Prior to this a snowstorm was encountered at Wrigley Harbor, but the plane shot through it without pausing. The tributaries of the Mackenzie River, winding away up into their sources in the mountains, thousands of lakes, large and small, and streams were spread out before the vision of the airmen like a map.

By the time the site of Old Fort Norman was reached the plane was flying at an altitude of 4,000 feet, and through the clear atmosphere could be seen the ice shining on the surface of Great Bear Lake, 75 miles to the northeast, and the gorge of the Great Bear River through the Franklin Mountains.

One notable feature of the journey was the making of a forced landing between the far North Forts of Simpson and Wrigley on the surface of the Mackenzie River. The only one around to help the crew in departing was an Indian who had been attracted by the descent of the great bird. It would be difficult to imagine the amazement of this aborigine at seeing this plane hurtling down the river and then rising aloft into the air again.

On landing at Fort Norman the machine crashed, shattering one of its pontoons and one wing. This accident, it was explained, was due to the extremely smooth and mirror-like surface of the water, which made it impossible to calculate accurately the height of the machine above the river.

The surveyor and geologist, immediately upon landing, proceeded with a party of men to stake claims.

Flying Very Popular in Britain

Taking flights in aeroplanes in Great Britain appears to be no more thought of than taking a ride in an automobile or a street car. Messrs. J. V. Holmes and O. R. Jones, two veterans of the World War, in charge of an Avro aeroplane, have visited various towns and cities in England and Scotland, and judging from the large number of people they have taken up for flights they are doing a land office business and will soon be rolling in wealth. At Dumfries, the first place visited in Scotland, no fewer than 1,050 persons went up in the ten days of their visit. At Annan where they stayed five days 400 people took flights, and at Lanimer 300 people sailed heavenwards for a brief space. Upwards of 15,000 people have been taken up at one time and another by these airmen, and no untoward mishap has occurred.

Interesting Flight in Peru

Lt. Lloyd Moore, chief pilot for the Compañia Nacional Aeronautica, made a very interesting flight from Lima to Huraz, a distance of over six hundred miles over the Andes.

The trip from Lima to Huraz was most interesting. They left the field in Bellevista in a very heavy fog which caused them to climb to an elevation of 15,000 feet. Then taking their course by compass, they continued, but upon reaching the vicinity of Huraz the clouds were so dense that they could not see to make a landing. They could do nothing but fly until they found a spot clear and a place to land. They did this at the end of a flight of two hours and a half, landing on the shelf of a mountain, at an elevation of 12,600 feet, two kilometers from Mollepata. Upon landing they saw some natives running to hide. At the end of an hour they succeeded in getting one of them near enough to make them understand that they wanted to know where they were. In the meantime other Indians had run to the village, and going to the office of the alcalde, told him that a large condor had landed and that two men had climbed from its back. They were received like kings in the town, runners were sent to a near ranch for gasoline, and they continued their trip the following day.

On the trip from Mollepata to Huraz they came into a strong upward current. When they passed "Huascaran," the highest peak of the Andes, which has an altitude of 26,420 feet, the machine attained an altitude of 25,000 feet. They made two turns around this peak, on the second turn having an altitude of 28,600, the people of Huraz watching the flight.

Mrs. Peck, the woman mountain climber, in her book of her fight in climbing Huascaran, does not speak of lakes on the top. Lt. Moore states that there are three lakes on the top, and the papers of Lima now question the fact that Mrs. Peck ever reached the top.

The flight home was without incident. The flight was made in an S V A No. 10, with the SPA motor.

Gabriel Voisin Killed

The famous French aviator Gabriel Voisin lost his life and caused the death of a passenger as the result of flying low enough to shout a message to his brother-in-law that he was coming back for dinner.

Voisin had just started for an aerial promenade with a friend. He turned back toward the villa outside of Juvisy where he was staying, and when he arrived within earshot of his brother-in-law standing in the garden, shouted: "Wait with dinner for us."

But he had cut off the engine and the machine failed to clear a hedge and crashed. Both pilot and passenger were killed.

Competition for Aircraft Safety Tanks

The British Air Ministry announces:-

The possibility of aircraft catching fire in the air has been almost entirely eliminated by care in design and inspection, but such precautions are not sufficient to protect, in every case, an aeroplane from the results of a crash.

One of the main objects still to be attained is to ensure that in a heavy landing or a crash the fuel tanks on an aircraft, even though seriously damaged, will withstand the shock to which they may be subjected without either bursting or leaking.

Accordingly, with the object of obtaining for use in Service and Commercial aircraft safety tanks which will fulfill these conditions and which will at the same time withstand the effects of enemy action by machine gun and shell fire a competition for safety fuel tanks has been arranged to commence on December 1, 1921.

Prizes to the extent of £2,000 will be awarded to the entrants of the tanks which are considered best. The first prize will be £1,400, the second £400 and the third £200.

The competition will be held at a place which will be decided upon later.

Any competitor may enter several different types of tanks, but two specimens of each type must be supplied for preliminary tests and four for the final tests. Entries, which should be addressed to the Secretary (R. D. I.) Air Ministry, Kingsway, London, W. C. 2., marked "Safety Fuel Tank Competition," will be received until November 7, 1921. These should be made on a form which will be supplied on request.

The control of the competition will be in the hands of a judges' committee appointed by the Air Council. Their decision as to awards shall be final and without appeal.

Tanks should be constructed so as to prevent as far as possible leakage or ignition of fuel when subjected to stresses similar to those to which the tank would be subjected in an aircraft crash, and to machine gun fire using incendiary, armour piercing, or explosive ammunition. Equal importance is attached to these requirements.

A tank is to be capable of being fitted within a space of 2 feet 6 inches by 2 feet by 2 feet and to have a capacity which must be within 5 per cent. of 30 gallons, but any shape of tank will be accepted for competition. All the necessary fittings to enable the tank to be mounted in a structure for testing purposes must be supplied by the competitor.

The maximum weight, which would only be justified by very exceptional qualities, should not exceed 1.75 lb. complete with fittings per gallon capacity. Tanks exceeding this figure will not be disqualified, but great importance will be attached to low weight.

In all cases the tank is to be complete with the necessary fittings to enable it to perform its functions of supplying fuel to a fixed point.

In the case of tanks designed to incorporate leak detectors and similar instruments and devices, these will be fitted in such a manner as to show their efficiency under test, and will be included in the weight. In every case there must be at least one filled and also unions for supply and delivery connections, one of the latter at the top, the other at the bottom of the tank.

The relative importance of other characteristics of the tanks will be considered in the following order:—Light weight, durability under service conditions in the absence of any accident, indifference to extremes of temperature, adaptability of design to large capacities, simplicity of construction, adaptability of design to various shapes, accessibility of fittings, cost of production.

All tanks will be submitted to preliminary trials. The three best types will be selected by the judges for a final trial.

For the preliminary tests both tanks submitted will be subjected to a crashing test of the following nature:

Each tank will be mounted in a wooden structure and located behind a concrete body formed to represent an engine. The tank will be released down a wire ropeway approximately 100 feet high, so arranged that the structure will strike the ground at an angle of not less than 45 degrees from the horizontal and will be free to turn over. This will ensure as far as possible the conditions prevailing in a typical aircraft crash. The tank will contain 22 gallons of petrol which will be supplied by the Air Ministry.

In the four tanks supplied for the final tests minor modifications of the original design may be made, provided the judges have previously decided that the modification is one of detail and not fundamental principle. The tanks will be required to undergo a similar crashing test as in the preliminary stages and also a firing test in which they will be subjected to machine gun fire with ammunition capable of penetrating the ordinary type of mild steel fuel tank and leaving small entry and large exit holes when the tank is struck below fuel level, and exploding and igniting the fuel either on contact or after penetration.

A series of bursts of five rounds each will be fired at a range of 50 yards, the tank being examined after each burst. The angle of fire will be at the discretion of the judges.

At any time during the competition the judges may impose such other tests (e. g. to determine the resistance to acceleration, etc.) as they may desire in order to demonstrate the relative merits of competing tanks.

There will be an interval of at least eight weeks between the preliminary and final tests.

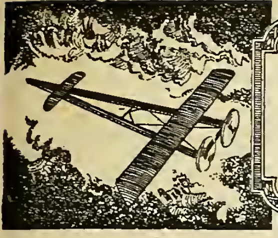
In the case of scout aircraft the stress due to acceleration may amount to three or four times that due to gravity.

Bourget Air-Pageant

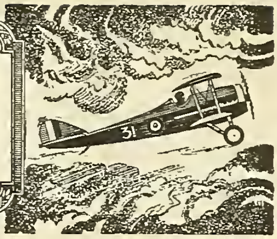
For this year the idea of a French Air-Pageant has been shelved. It is to be held at Easter, 1922, at Bourget. M. Flandin is the Hon. President of the Organizing Committee, and M. Léon Bathiat, President. Eighty per cent. of the profits goes to the funds for relief of aviators and the balance to a similar fund for sporting journalists.

The "Movies" in an "Aeroplane"

A novel form of show is foreshadowed in the registration of a company, under the title of Holcroft Cinema Aeroplane, Ltd. The *raison d'être* of the company is to provide a cinema entertainment actually given in a large model aeroplane invented by Major Charles Holcroft, which performs certain motions and gives to the public the benefit of cinema entertainment coupled with the sensation of flying, etc. Mr. E. Lewis Waller is a director of the company.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



How To Build a Flying Scale Model of the Curtiss 18-T Triplane

Tail Plane Construction

(Continued from last week's issue)

SPARS are made of ⅛" by 1/16" white pine. Correct lengths outline, drawing of the tail planes and marking off the cor- are cut by laying the material directly on a full-sized rect length and relative positions of the spars. Edging is bent to shape over a candle flame and secured to the frames, or spars, as shown. Cover them with silk or silk paper. If silk is used, varnish with bamboo varnish.

Landing Gear Construction

Cut the landing gear strut material to the streamline section as shown on the drawing. Cut two front and two rear struts to the length and shape shown and then cut the slots in the ends to insert the small veneer pieces. Cut a small veneer piece from 1/16" thick mahogany or white pine. Insert the small veneer piece in the struts and glue them fast and let dry. When they are dry, drill a 1/16" hole for the axle to fit in.

Cut the tail-skid to the shape and size shown. Insert it in the opening made for it underneath in the lower half at the rear of the fuselage and glue fast.

Construction of Motor Stick, Nose Piece and Hanger

Make the nose-piece of white pine ½" thick and cut to the streamline shape. Drill a ⅛" hole for the ball-bearing shaft to pass through and a 5/16" hole for the ball-bearing race to fit into. Cut out the insertions by which the piece is secured to the front end piece of the body and drill a 1/32" hole through the centers. Cut out a 1/16" deep groove on the back side, for the propeller hanger to fit into.

Propeller hanger is cut from a piece of brass 1/16" thick, 4⅝" long and ¼" wide. Drill all holes before bending the piece to shape. Insert the hanger in the 1/16" deep groove in the nose-piece and fasten with ¼" screws.

Cut the motor stick from a piece of ¼" square white pine. Screw the rear motor hook in place and fasten the motor stick to the hanger with ¼" screws.

Propeller Construction

Secure two pieces of the very best straight grained clear *dry* white pine ⅞" in thickness. Cut the pieces to the shape shown. Make a *good* half-and-half lap-joint and glue the two blocks together and clamp tight until thoroughly dry. When dry draw the propeller outline on the blocks and saw out on a bandsaw or jig-saw. Taper the ends as shown in the side view of the propeller drawing. Carve out the blades, leaving a rather thick cross section as shown. Sandpaper nicely and give two or three coats of bamboo varnish.

Assembly of the Parts

First insert the spars of the lower and middle planes in place. Attach the interplane struts and glue them fast. Attach the upper main plane to the struts and glue fast. Wire with No. 34 tinned wire.

Insert the stabilizer plane in place and glue fast. Attach the elevators with No. 34 wire. Insert the fin and glue fast. Attach the rudder to the fin with No. 34 wire.

Insert the landing gear struts in place and glue them fast. Put the axle and wheels on as shown. A 1/16" inside diameter brass tube may be used as a spacer to keep the struts from bending in. Wire with No. 34 tinned steel wire.

Nail the ⅛" square motor stick brace in place and glue. Insert the ball-bearing propeller shaft through the nose piece and hanger and make a neat hook on the shaft. Screw the nose piece to the front end piece of the body and fasten the motor stick to the rear motor stick brace with a strip of rubber as shown. This will permit the motor stick to twist. Screw the propeller on the shaft and line everything up nicely and truly.

If the balance point is found to be not at the correct location new holes may be drilled and main planes set back sufficiently. See that everything is nicely trued up, before flying. Use about ten or twelve strands of 3/16" flat rubber as motive power.

Models Built By Readers of Aerial Age

The Fokker model, illustrated in the photograph below, was built from plans published in Aerial Age on January 24th. Its builder, Mr. D. A. Marshall, of Toronto, Canada, has recently added this type to a rather extensive collection he now has of well-known types of aeroplanes.

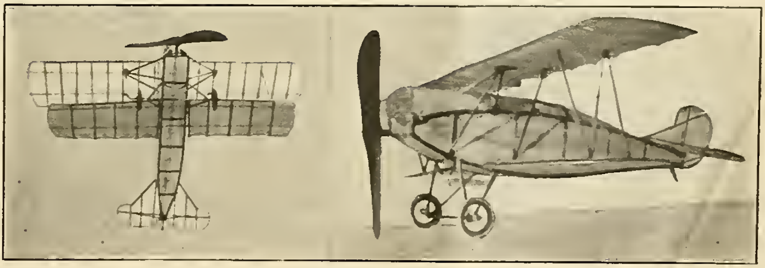
Mr. Marshall is keenly interested in the development of model aeronautics in Toronto and will lend his aid to foster the suggestion of a Toronto club broached in Aerial Age recently. Encouragement of the right sort has been given to model builders by Col. Barker, the noted Ace, who gave two prizes a little more than a year ago when he opened up Broadview Boys' Fall Fair. As prizes, aeroplane flights were awarded—a fifteen minute trip for first prize and a ten minute trip, second. Mr. Marshall's skill in model building was rewarded by the first prize trip, which naturally gave him the desire to fly a machine of his own. It is likely that Mr. Marshall will attempt the construction of a motor-cycle engined aeroplane and that Aerial Age readers can expect to hear more of his accomplishments.

New Names Suggested For Motorcycle Engined Aeroplanes

One of our readers, commenting upon the article published in Aerial Age on the subject of an "Aeroplanette" Club, has some ideas on the subject which seem to be an improvement on the first suggested name. Inasmuch as the wing, plane or supporting surface is the outstanding and distinctive feature of an aeroplane, it is suggested that the names "Motorwing" or "Motorplane" would be more appropriate and more convenient for general use.

It may have been noticed by our readers that the word "aeroplane" is used entirely throughout the editorial columns of Aerial Age. As some of the newspapers and other publications have adapted the name "airplane" there seems to be an open question as to which name is in the most general use. In justification of our use of the word "aeroplane," let our readers observe for themselves how many times they hear the word spoken *"aeroplane"* and how seldom they hear the word pronounced with the "o" omitted.

The Fokker D-7 Scale Flying Model Built by D. A. Marshall from plans published in Aerial Age



A-E-R-O-N-I-T-I-S

Starting the Day Right

A pretty stenographer had been transferred by the firm to another city. The first morning after the change had been made, she came into her new office, hung her hat and coat on the rack and meandered leisurely to the boss' desk.

"Well," she said, "I suppose you start in the day here the same as we do in Blanktown?"

"Why, yes, I suppose so," replied the boss.

"Well, come on, then, kiss me so I can start working."
—*Whizz Bang.*

How to use a telephone: Take up receiver. Yell "Hello." Yell "Hello" again. Yell "Hello" six times. Then yell only the first syllable of "Hello." Then put the last syllable before the first and yell that. Then hang up.—*Our Navy.*

Chief: "Line up alphabetically, the 'A's' first, then the 'B's; what's your name?"

Boot from North Dakota: "Phillips, sir!"

Chief: "Phillips, wotell you doin' up the head o' the line, get down among the 'F's' where you belong."

How Come?

Found—Lady's lingerie and stockings with auto cushion in pasture on Oak Blvd., two miles south Vernon road near the Morgan farm called "Buenos Aires."—*Whizz Bang.*

A tool chest was the old hen's nest,
I'll bet you cannot match it;
She cackled when she tried to set
Upon a nail and hatchet.
—*Whizz Bang.*

Might Understand

"You don't deny that you were exceeding the speed limit?"

"No, your honor."

"Have you a valid excuse to offer?"

"Not a valid one, I'm afraid," replied the motorist, dreamily, "but you ought to see the girl who asked me to 'step on the gas.' "—*Birmingham Age-Herald.*

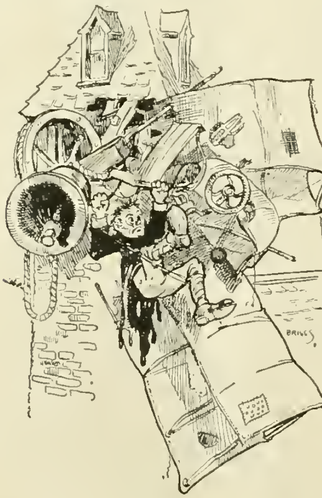
Kriss: "That girl doesn't care how much of her leg she shows."

Kross: "Neither do I."—*Judge.*

Silly

He: "Are we alone, dearest?"

She: "No, I think we're together."—*Judge.*



"CURFEW SHALL NOT RING TO-NIGHT!"

The Lure of the Air

This is the reason we love the Air:—
This is the reason our joy is to fly:—
For up on high there are beauties rare
For which the "Earth-bound" in vain shall sigh.

Then come for a flight in the beautiful blue;
In a plane that's built just 'special for two.
High up o'er the clouds we swiftly will climb
A view there, a picture, that's truly sublime.
Below us the cloudbanks like silver and gold,
A sight of rare beauty to our view does unfold.
And up o'er our heads, still quite far away
The Heaven's true blue we with joy shall survey.

Then a Dip and a Dive, A Spin and a Glide,
And now once again near the earth we shall ride,
But ever, deep in our hearts is there,
The call of the CLOUDLAND, THE LURE OF THE AIR.
B. H. Krueger.

Too Much to Hide

Oscar contends
That when a lady
Spends $8 for a pair of hose
She has a right
To display
At least $7.50
Worth o' them.
—*Columbus Dispatch.*

Peter Piper played a pot of poker,
A pretty pot of poker Peter Piper picked.
But a piker with a poker picked on Peter Piper.
And pocketed the poker-pot that Peter Piper picked!
Naval Academy Lag.

He Took the Hint

He: "If I should kiss you, would you scream for help?"

She: "I certainly should—if you required any."

Visitor (at remote fishing village): Ah, a library?

Postmistress: Yes, sir, but you're too late. Another man just borrowed it.—*Landon Opinian.*

Sandwich Isles

Mary had a little lamb
Between two hunks of bread,
The S. P. C. A. did not complain
Because the lamb was dead.
—*Vaudeville News.*

Hard Luck

Knick: "What made you delay your trip to the country?"

Knack: "After the trunks were all strapped I found I was, too."—*Judge.*

Curtain Time

Mary wore two silken sox,
Rolled down below her knee;
But Mary once had chicken pox;
Which spoiled the scenery.
—*Carnegie Puppet.*

Footpad: "Hey. Bo! Yer money or yer life!"

Wayfarer: "How dare you address me in such a vulgar manner! Have we been introduced?"
—*Le Journal Amusant* (*Paris*).

A Sure Shot

Two jags were returning home after a big spree lasting nearly all night.

"Don't your wife miss you on these occasions?" asked one.

"Not often," replied the other, "she throws pretty straight."
—*Texas Scalper.*

"What have you to offer my daughter in case I give my consent?"

"Well, I'm studying law, so I shall be able to offer her free legal advice."—*Boston Beanpot.*

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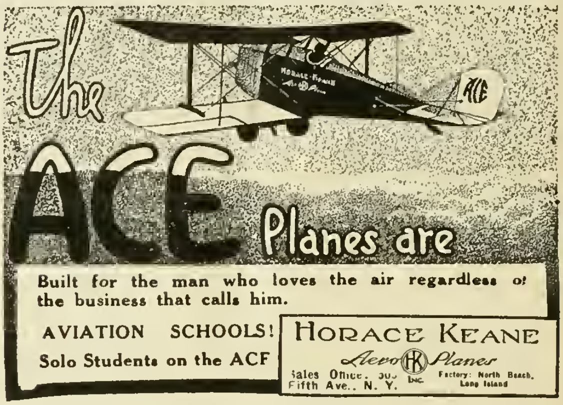

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(*Continued from page* 11)

or may be higher. The limits of the ignition velocity utilized in the engine are about 1.5 to 2.5 m/sec. (5 to 8 ft. per sec.) and therefore at these ignition velocities, the thermal value of the mixture would be highest with gasoline, and lowest with hydrogen. This also explains why the highest mean effective pressure ever attained, between 9 and 10 kg/cm², (128 to 142 lbs. per sq. in.) was to be found in the gasoline engine.

This opens up another profitable field of study—that of the ignition velocities of gasoline and all other economically utilizable fuels over a wide range of temperatures from those encountered at the beginning of compression to the temperatures at the end of compression. Nusselt believes the effect of initial temperature is very great.

The lecturer finally considered the question of weight of the aviation engine which must always be more important than the fuel problem.

$$\frac{G}{N} = \left(\frac{P_{max}}{P_m} \cdot \frac{\frac{d}{s}}{V_m} \right) + A \qquad (4)$$

Equation 4 expresses the engine weight per horsepower when the engine is considered as an intergration of mechanical energy from several units, and as a transmitter of energy from the several combustion chambers through the piston, connecting rod linkages to the shaft, and thence to the propeller, on which the forces p act at different points. The power N of the engine depends upon (1) the mean value P_m of the forces applied to the pistons and (2) the relative velocity V_m between the moving and stationary parts of the energy conduit. The product $P_m \cdot V_m = N$ remains constant (apart from losses due to friction) in all the cross sections of the energy conduit. The structural material used, and consequently, the weight G is, on the other hand, essentially determined in every section of the energy conduit by (1) the maximum forces P_{max}, (2) the admitted strain s and (3) the specific gravity d of the working material. A is a supplement for the fuel conduits, the valve gear, and other accessories.

The principal determinations for the value G/N are the following: (1) the absolute length (1) of the energy conduit; (2) the permissible value s of the structural material; (3) the permissible maximum values for V_m, and (4) the value $\frac{P_{max}}{P_m}$.

The value of $\frac{P_{max}}{P_m}$ for the piston, valve gear and the cylinder is equal to the value of $\frac{P_{max}}{P_m}$ for the entire engine, and in the case of the cylinder and piston, the ratio of the maximum pressure P_{max} to the mean pressure due to inertia of the masses must be taken into account. The following deduction may be drawn from equation (4). Should P_m be less than normal, in consequence of a low cylinder charge or the heating of the intake mixture to a high temperature, P_{max} will be lower in proportion, so that the ratio $\frac{P_{max}}{P_m}$ remains unchanged. The engine with reduced volumetric efficiency will not of necessity be heavier as it can be built considerably lighter because the quotient $\frac{P_{max}}{P_m}$ alone is decisive. When the compression ratio is low, this quotient is generally lower, so that air-cooled rotary engines turn out very well with regard to their H.P. load, in spite of their unfavorable volumetric efficiency and their low compression ratio. (This is certainly also due to the short length of the energy conduit "1" and to the lightness of the accessories A.). This relation shows that aviation engines can be perfectly well built with low weights per H.P. when using prepared fuel mixtures, in spite of the fact that they take in hot air or have extremely hot walls in order to obtain adequate vaporization, or they work with low pressures during the suction stroke in order to obtain adequate atomization.

The combustion type of engine therefore should not be chosen for aviation, or light automobile engine designed for the use of fuels of high boiling point. The latter will always be more difficult to construct on account of its high value of $\frac{P_{max}}{P_m}$ (without taking the heavy accessories into considera-

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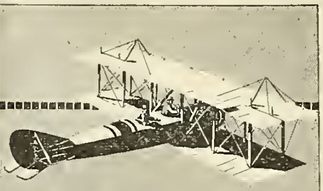

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tion). The aviation engine should rather be selected from the ignition engine class with the best possible atomization and comparatively low compression ratio. With this end in view, a systematic investigation should be made of all the important characteristics of fuels, so that the heavy-oil aviation ignition engine may attain the unusual record values which now distinguish the best light-oil ignition engines from all other combustion engines, namely:

Gasoline consumption—180 to 190 grams, 0.40—0.42 lbs. per H.P. hr.
Mean useful pressure—9 to 10 kg/cm^2, 128 to 142 lbs per sq. in.
Load per H.P.—Only 0.8 to 1.5 kg., 1.8 to 3.3 lbs. per H.P.

Note I

The surface tension of the fuel is probably of much greater importance than its viscosity in affecting atomization.

Note II

This is not true should the temperature of the gasoline decrease as the air temperature decreases with increasing altitude. It is probably true, should the temperature of the gasoline in tanks and fuel lines remain the same in flight as on the ground.

Note III

This assumes no heating of the carburetor or manifold.

Note IV

Cooling of the entire weight of air necessary for one pound of hexane 30°C would supply about 193 B.t.u.; whereas, only about 143 B.t.u. are required.

Note V

It is very doubtful that hexane is the principal component of any of the present commercial gasolines, evcept possibly, aviation gasolines.

Note VI

If the values given are for the chemical combining mixture ratio of 15.2 to 1, the manifold pressure assumed is 731 mm. mercury. Should the manifold pressure be assumed as 760 mm. of mercury, the mixture ratio will be 15.7 to 1.

Note VII

The mixture ratios for the saturation values of the fuels given in Figure 4, as computed from published data, are as given below:

	Mixture Ratio	*Manifold Pressure mm. of Mercury*
Naphthaline $C_{10}H_8$	12.5	760
	12.9*	785
Decane $C_{10}H_{22}$	15.7	760
	15.0*	738
Ethyl Alcohol C_2H_5OH	8.8	760
	9.0*	774
Benzol C_6H_6	15.0	760
	13.2*	669
Hexane C_6H_{14}	15.7	760
	15.2*	730

*Chemical combining ratios.

Note VIII

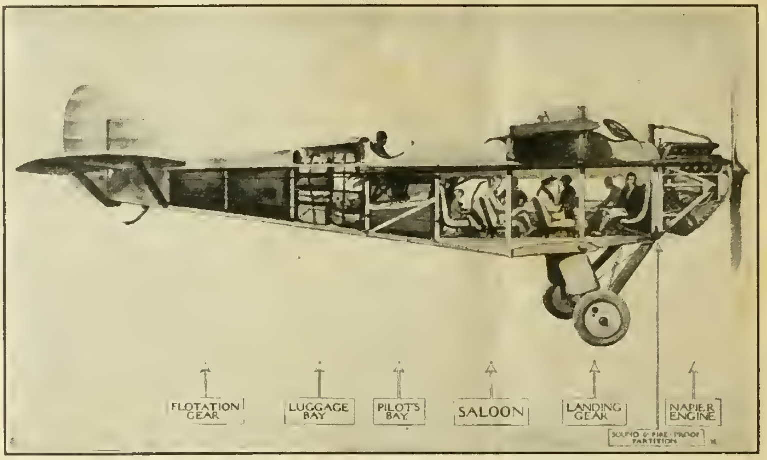
Were all temperatures mentioned higher than the saturation temperature of the fuel at the pressures existing, *no* condensation or separation could take place.

Note IX

This is not altogether true, as the engine may be idle at times which precede demands for reliable engine operation, such as when coming out of a long dive and rising from the ground after an unsuccessful attempt to land.

Note X

When H is in kilogram calories per cubic meter and P_m in kilograms per cm^2 the constant of proportionality is $\frac{427}{10,000}$ when H is in B.t.u. per cubic inch and P_m in pounds per square inch the constant of proportionality is, 778 x 12.



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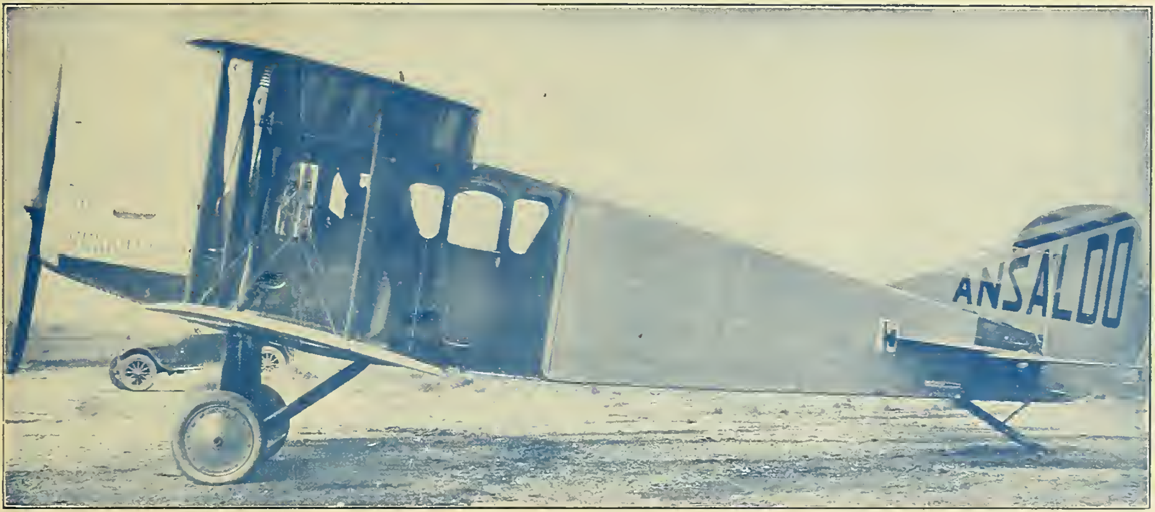

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Airscape of the Business Section of Salt Lake City, Showing State Capitol in the Distance. Photo by Wilson

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March 25, 1915 at the Post Office at New York under the Act of March 3rd, 1879

AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

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The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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AERIAL AGE WEEKLY **280 Madison Avenue, New York**

September 19, 1921

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TABLE OF CONTENTS

The Need for More Engineering in Aeroplane Design 27
Weight Estimation in Aeroplane Design 27
The News of the Week............ 28
The Aircraft Trade Review........ 30
Cox-Klemin Rebuilds Standard with Mercedes Motor 31
Senator Wadsworth Introduces Bill to Regulate Flying and Develop American Aviation 31
The Employment of Airships for the Transport of Passengers 33
The Nieuport-Delage Airplane, Type 30-T 37
Foreign Technical Digest 38
Naval and Military Aeronautics.... 39
Foreign News 40
Elementary Aeronautics and Model Notes 41
Aeronitis 42

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VOL. XIV NEW YORK, SEPTEMBER 19, 1921 NO. 2

The Need for More Engineering in Aeroplane Design

NEARLY everyone today will admit the desirability of more engineering and better engineering in aeroplane design. But in commercial work the objection is raised that the expense is too great to be justified. From the viewpoint of immediate returns this contention is sometimes correct, though by no means always. Leaving out of consideration for the moment the problem of direct financial return, how should this question be answered, "Where human lives are concerned is it ever justifiable to skimp on the engineering, or to employ any but the very finest talent that can be had?" If the reader believes that this is not a live issue let him refresh his mind with the terrible disaster to the ZR-2. This was primarily caused by a structural failure, the buckling of one of the main longitudinal girders. Though the responsibility cannot be definitely placed, this failure was probably due to faulty engineering. Forty-three lives and $2,000,000 snuffed out in the space of five seconds—rather a high price to pay for failure to secure the best engineering ability. If this structural defect had been the only bit of poor engineering on the ship, most of the crew would have been able to escape in parachutes, even though the structure did collapse. Unfortunately, owing to a poorly designed fuel system or power plant installation, either the hydrogen or the gasoline exploded with terrific force. It appears that the British during the war lost six or seven airships through fire originating, not from external attack, but within the ship. On the other hand, the Germans had but one airship destroyed in this manner on account of a difficulty that was remedied at once. Would a commercial concern buy an airship from the English company, the builder of the ZR-2, or from a German firm with a clear record? This is a concrete illustration of whether the best engineering pays.

Recently the aviation world received another shock in the collapse of the Jacuzzi monoplane in California. Does any one suppose that if a really competent engineer had designed the wing structure it would have failed? It's rather costly to kill four men and destroy an entire aeroplane to save the expense of a consulting engineer who knows his business.

The certain "Bullet" would not have proved a death trap for several fine fellows had its wings been properly designed. Neither would some of our air mail pilots have been burned to death in JL-6's had the designer of this otherwise admirable aeroplane been a specialist in fuel systems, and understood the precautions for reducing fire hazard. Does it pay to have the services of the highest grade technical men in the country?

Most aeroplane accidents caused by defects in design go to prove the contention that very few men are capable of carrying the entire responsibility of the design of so complicated a machine as an aeroplane. They must have the direct services of various specialists who devote all their time to intensive study of problems in their own field, which may be fuel systems, power plant installation, stress analysis, aerodynamics or production and maintenance. Or they must be thoroughly conversant with the writings and reports of these men. The outstanding point is that if air transport is to become safe, reliable and cheap there must be specialists, highly trained engineers, each solving his own problems and difficulties. If those who advocate the abolition of such institutions as McCook Field, the sole centers of the research and development work which alone will make possible commercial aviation, realized the true facts in the situation they would soon reconsider their stand unless actuated by entirely selfish and short-sighted motives.

Sound engineering from the start is better security than any insurance policy that can be written. In the long run it is far less expensive in direct cost than insurance, especially if a number of aeroplanes of the same type are operated. But aside from this, no amount of money can replace lost lives, and the responsibility for their loss lies at the door of the men who say, "Commercial aviation cannot afford to spend more than the minimum for engineering." B. C. B.

Weight Estimations in Aeroplane Design

UNTIL within the last two years the general tendency among designers was to underestimate weights. This was partly due to lack of data. The designer, having to depend to a large extent upon his judgment, was apt to be as hopeful as possible in guessing at his weights in order to make a good showing in predicted performance. This easy and comfortable self-deception received a few rude shocks when the aeroplanes with full load were weighed, and not found wanting—by several hundred pounds. As a result they were practically failures on account of high wing and power loadings. There were also other factors, however, responsible for underestimated weights. Many designers who were engineers enough to make an entirely honest estimate, and who did come reasonably close to the truth so far as the main structural parts were concerned, because of lack of experience failed to account for the many details on an aeroplane which, though small taken separately, in the aggregate amount to a large percentage of the total weight. Still another cause,, generally beyond the designer's control, contributed its share to an underestimate of the final weight. This was the increase in load (misnamed useful) which the unfortunate ship was compelled to carry. This condition was particularly true of military aeroplanes designed during and just after the war. Each section, equipment, photographic and armament, wanted to be fully represented by the very latest, largest and heaviest apparatus available. The endeavor to make the same aeroplane serve for light bombing, fighting and observation resulted in the addition of bomb racks, wireless outfits, oxygen sets, cameras and the rest, till the unlucky aeroplane resembled a Christmas tree. Since then the military load for each type has been standardized and is a quantity known in detail at the beginning of the design.

As a consequence of all this there came a strong reaction among many of the best designers to be very conservative in preparing weight estimates. This change in attitude greatly improved the truthfulness of the estimates. Now, instead of the designer having high hopes in regard to performance prediction up to the time the construction of the aeroplane was completed, he often became discouraged at the start of the design, knowing that with the high weight, which experience had taught him was apparently inevitable, a good performance was hardly possible. This reaction had a natural psychological effect on the designer who felt his weights were running so high anyway that it was hardly worth while trying very hard to keep them down. The result was, of course, what one would expect.

Last fall there came to the attention of the Enginering Division a design by one of the leading engineers in the country, that was unique in several respects, but in none more than in its extreme low weight which was about three hundred pounds in twenty-five hundred less than the average weight for that type of aeroplane. By this cut in weight the designer was able to meet the very severe performance requirements which otherwise would have been unattainable. At first his estimates were met with an amused incredulity, tinged with slight impatience, by Government engineers, including the writer, who were accustomed to the high weights of existing aeroplanes. They reasoned first gently, then heatedly with him but he stuck to his figures and offered that very convincing argument, a money guarantee, that he could meet his estimate. He had seen that the only hope of an aeroplane of the type he was working on was in extreme light weight. He had accordingly gone to the very limit, consistent with the Government's severe strength requirements, and used thin gage alloy steel tubing for his fuselage, a deep section for his wings which were externally braced, developed ingenious fittings of high grade steel, used special balsa fairing very cleverly, and made the whole aeroplane small and compact. He had seen a great light and in so doing performed a service to aviation.

The real way to prepare a weight estimate is to make it low, not trusting to Providence the task of keeping ordinary construction within the limits set, but resolutely resolving that not a superfluous ounce shall go into the structure, and especially the non-structural details, then proceeding to make use of the lightest and strongest materials available, to design and redesign the parts till satisfied they are the irreducible minimum so far as weight is concerned.

One caution must be always borne in mind, however: when cutting weight do not, in too great a burst of enthusiasm, make the parts so light as to be flimsy. An aeroplane must stand hard service and must be rigid. B. C. B.

THE NEWS OF THE WEEK

ZR-2 Memorial Service in Westminster

Airmen of the United States Navy and the British Royal Air Force united September 7 in a service for the victims of the ZR-2 disaster "amid the memorials of Great Britain's most illustrious dead," as one of the prayers expressed it, in Westminster Abbey.

Air Commodore Maitland, D. S. O., and Commander Louis Maxfield, U. S. N., were especially mentioned in the official program, but among the mourners no distinction was made, and the wives of ordinary riggers and of scientific experts sat side by side in seats reserved for them. Ambassador Harvey, Vice Admiral Niblack, Rear Admiral Twining and Consul General Skinner were among the well-known Americans seated in the choir. Near them were representatives of the King and Queen, the British Cabinet and the naval, military and air forces. The Lord Mayors of London and Hull and the Mayors of Westminster and Bedford attended in state, and a large number of British flying officers, with rows of ribbons won by hard adventure worn across their tunics, also came to pay tribute to their fellow-aviators.

The general public filled every seat in the nave, hundreds being turned away disappointed. Just before the service began a detachment of sailors from the United States battleship Utah marched in. Near them was another group of American sailors of still more significance. They were all that are left of the crew of the ZR-2, men who were left behind at the Howden aerodrome as she started on her last cruise.

An address was read from the chancel steps by the Rev. H. D. L. Viener, chaplain in chief to the Royal Air Force. He described how the Americans and British air forces had been associated in developing "a once formidable engine of destruction into a pioneer of closer commercial relations," and dwelt upon the horror of the catastrophe when long months of training were over and only the eagerly awaited voyage home seemed to remain.

"The price of progress and the toll of science," he exclaimed, "are bitter enough. Yet, thank God, there is never lack of splendid men ready to do and to dare. It is best so. To be in the forefront of the fight to conquer what half a generation ago was an untried field will ever appeal to our splendid manhood."

As he finished the choir broke into "Mine Eyes Have Seen the Glory of the Coming of the Lord," and never did the old battle hymn seem to come with more appropriateness. The service closed with prayers and a hymn which here is imperishably associated with trials, vicissitudes and triumphs of the great war, "O God, Our Help in Ages Past." Then, after the blessing, the congregation stood motionless as the bugle notes of "The Last Post," wailed through the lofty arches and the American and British national anthems were sung.

Secretary Denby has been advised that the British cruiser Dauntless, which is bringing home the bodies of the officers and men of the navy who lost their lives in the ZR-2 disaster, will arrive in New York late on Sept. 16, or early in the morning of the 17th.

The ship will dock at South Brooklyn and ceremonies will be held on the dock at 2 o'clock Saturday afternoon, Sept. 17. All arrangements in connection with these ceremonies will be made by the commandant of the Third Naval District, Captain C. T. Vogelgesang.

Behnke Wins Chicago Air Derby

Chicago.—Covering the fifty-five-mile course in forty-nine minutes, David Behnke of the Checkerboard Field won the Labor Day Air Derby Sept. 5. Each flyer carried a passenger. Price Hollingsworth finished second, followed closely by John Kiser and James Curran. Charles Dickinson, a sixty-five-year-old pilot, finished only a few minutes behind the winner.

The contestants were rated on reliability and speed. Designated turning points were marked and pilots who failed to turn at spots constituted were charged with fouls.

King Alfonso Secures Plane

Paris.—A Potez biplane, designed and built especially for King Alfonso of Spain, left Villacoublay at 8.50 o'clock, Sept. 5. The builders expect the plane to average 210 kilometers an hour. The plane bears the Spanish royal arms and is destined for the exclusive personal use of Alfonso.

Newspaper Aero Edition

The Rochester *Democrat and Chronicle* has inaugurated an aero edition, which is being delivered to neighboring towns by aeroplane, and which is arousing very great interest in the community. The various parcels for the different towns are dropped by parachute.

Spokane News

Spokane, Washington.—The development of interest in aviation has proceeded steadily in Spokane and vicinity. In one day last week there were 10 planes on the Foster Russell landing field. They included the machines of Fred W. Hungate, a banker and wheat grower of Pomeroy; Albert Hubbard, a Spokane inventor; Charles E. Stilwell, theater owner; J. G. Rankin, pilot, Walla Walla; W. H. Fouts, an attorney, Walla Walla; David Mathews, Moscow, Idaho; Spokane Industries, C. L. Langdon, pilot; Ralph Beal, Ritzville; and the Bluebird and standard planes of the Russell Company. Half of the visiting planes were flown by their owners or operators.

Four men are employed in setting up a new three-passenger plane for use on the field. It will be of 150 horsepower, equipped with an electric starter and will be ready for the air shortly.

New York Aviators Support LaGuardia

New York aviators who served during the War have organized a committee to further the interests of Major Fiorella LaGuardia, President of the Board of Aldermen, in the coming New York City mayoralty elections. President LaGuardia resigned his seat in Congress during the War to serve in the Army Air Service. He attained the rank of Major, and won several decorations for valor while fighting in France and Italy.

The committee recently met and presented to President LaGuardia at the City Hall a small model aeroplane, symbolical of the new ship of state, and the first communique from the Air Service to the people of New York.

The committee is headed by Jacques M. Swaab, who was cited for gallantry at Metz and Thiaucourt, and is credited with the destruction of 10 German machines, for which he received the Distinguished Service Cross.

American in French Accident

The body of the American who was a victim of the crash of a Strasbourg-Paris aeroplane at Le Bourget has been identified as that of Richard Perkins Parker of Salem, Mass., a son of Mr. and Mrs. George Parker, who with their daughter, Sarah, 13, are now returning to New York on the steamship Paris. Early reports that Mr. Parker was connected with the Morgan, Harjes & Co.'s bank here were denied.

The Parker family arrived on the Continent in July, leaving after a few days for Rome, and returning at the end of August to sail for home. Young Parker went to Strasbourg September 3. His parents have been notified of his death by wireless..

Officials of the aeroplane company blamed the accident upon the failure of the pilot to obey orders.

Ardmore Aero Club

The Aero Club of Ardmore has been organized with the following officers: Dr. Walter Hardy, Pres.; J. B. Champion, Vive-pres.; Harold Wallace, Treas.; and Florence Bradley, Sec. The club is not yet in a position to take up active flying and so for the time being plans to confine its interests to furthering the cause of aviation.

New Oklahoma Field

Report has been received of the establishment of a commercial aerodrome at this city. No details as to the location and ground marking of the field are as yet available, but it is understood that a company will be operating from it and that hangar space, fuel, and oil will be available.

Praeger Honored by Spain

The King of Spain has conferred upon Otto Praeger, of New York City, formerly Second Assistant Postmaster General, and head of the American delegation to the 7th Universal Postal Congress in Madrid last year, the decoration of "Commander with Star of the Royal Order of Isabel la Catolica".

Under Mr. Praeger's leadership the delegates of the twenty-one Latin-American nations joined with the United States and Spain in the creation of a model postal union, cooperating with the Universal Postal Union, but creating a more liberal and more uniform postal administration between the countries involved than the European nations were in a position to agree to in the Universal Postal Congress so soon after the war. Upon his retirement from the postal service last March, Mr. Praeger took up his residence in New York to engage in industrial research and investigation.

In the business world Mr. Praeger is known as the creator of the American Air Mail Service and reorganizer on a business basis of postal administration. As postmaster of Washington, 1914-5, he converted a typical public office into a working business concern. He speeded up the delivery of mail 50 per cent; increased letter and parcel post deliveries and collections throughout the city, and extended the postal facilities to take care of 20 per cent increase in business, at the same time reducing operating expenses at the rate of $37,000 per year.

Personal Par

Sir George H. Fisher-Smith, commissioner for Great Britain of the World Board of Aeronautical Commissioners, is now in New York. Sir George was formerly mayor of Halifax, England.

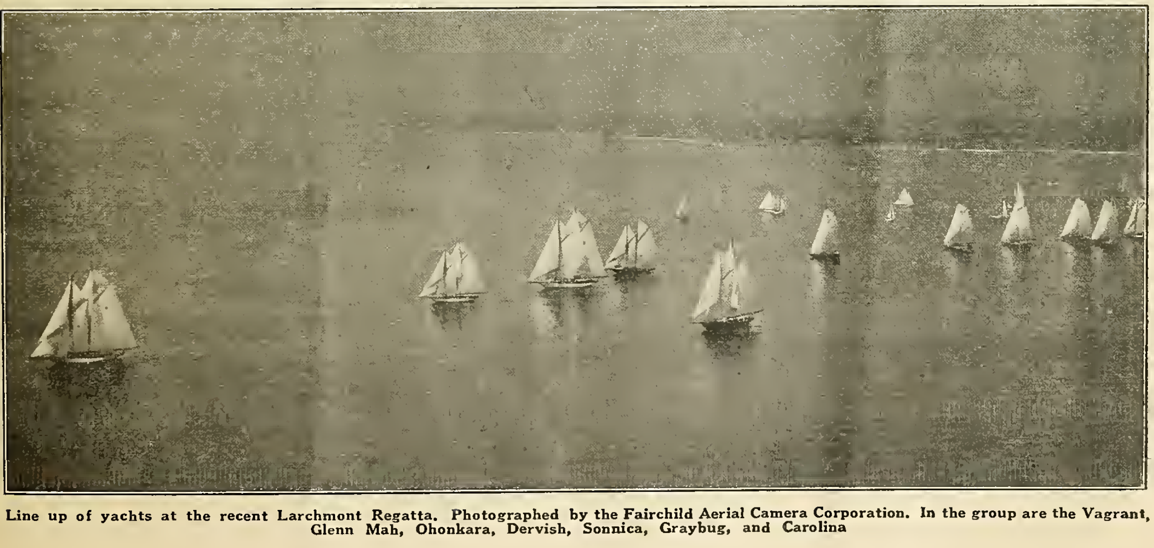
Benedict Crowell Aero Club Head

Benedict Crowell, former Assistant Secretary of War, was elected President of the Aero Club of America, September 9, to succeed Myron T. Herrick, who resigned when he went to France as Ambassador. Lieut. Col. Harold E. Hartney, who was head of the Civil Affairs in the office of the Chief of the Army Air Service, was elected Executive Secretary, to succeed Captain Maurice G. Cleary. Colonel Hartney commanded the First Pursuit Group on the French front.

Spokane News

Spokane, Wash.—Climbing 12,400 feet in an aeroplane above Spokane and then descending in a nose dive with terrific speed, Patrick Hennessey, 8-year-old son of E. S. Hennessey, recently made a vain attempt to recover his hearing. The flight was made from the Foster Russel aviation field on the Apple way east of town at 3:30 p. m. "Tex" Rankin piloted the 150 horsepower Curtiss plane.

The trip is 14,200 feet above sea level, believed to be a new altitude record here, was made in one hour and fifty-five minutes. The descent was made in two minutes, or at an approximate speed of 75 miles an hour. A large crowd which watched the flight was thrilled as the plane shot downward and the intrepid youngster waved his hand at them and smiled, although his great hope that he might hear again was not realized.



Line up of yachts at the recent Larchmont Regatta. Photographed by the Fairchild Aerial Camera Corporation. In the group are the Vagrant, Glenn Mah, Ohonkara, Dervish, Sonnica, Graybug, and Carolina

The AIRCRAFT TRADE REVIEW

Efficient Curtiss Service

We have recently had most favorable reports from users of Curtiss machines concerning the efficient service of the Curtiss Company in the matter of supplying spares promptly. It is a rule, seldom broken, that orders received in the morning mail or by telegraph—if parcel post packages suffice—are despatched that day. Oftentimes if crating is required, shipment is also made that day, and never later than the next day.

Orders received in Garden City for goods which are in stock in Buffalo and not in Garden City, where there is reason to suppose that the party is holding up flying the machine, are delivered from Buffalo that day, Buffalo being notified by wire.

The company has an excellent system of storage, which has been organized during this year at Hazelhurst Field for service parts, and the personnel handling service orders is the most expert available for the interpreting of telegraphic and other communications in this connection.

A Correction

In a recent issue of AERIAL AGE we stated that the Seaboard Consolidated Air Lines had purchased six Fokker limousines for service between New York and Washington. We have since been advised by the Netherlands Aircraft Mfg. Co. that this report is incorrect, and that as a matter of fact the Seaboard Company has not purchased any Fokker machines.

Easter Airlines Incorporated

The Easter Airlines, Inc., has been incorporated in Maryland. The headquarters of the company will be in Baltimore from which they intend to undertake passenger carrying, aerial survey and photography.

The president and manager of the concern is Ewing Easter, and the secretary and treasurer is Robert Strang. Other incorporators include C. I. Reynolds, E. McNeal Shannahan, George Orr, and Elliott Wheeler.

Bryant Represents Aeromarine

Traverse City, Michigan, will be the distributing point for territory north of Grand Rapids for the Aeromarine Airways Co. M. D. Bryant will represent the company in this territory.

Annual S. A. E. Meeting

The Society of Automotive Engineers has announced that its annual meeting will be held in New York City Jan. 10-13, 1922.

The Meetings Committee suggests that members desiring to present papers communicate with the Society offices at 29 West 39th Street, New York, without delay, since it is desirable that the acceptance of all manuscripts be decided by Oct. 1 in order to provide sufficient time for preparation and circulation of the preprints.

Ends 7,491-Mile Flight

Harry Bruno, advertising and sales manager of the Aeromarine Corporation, who landed in a flying boat at Eighty-second Street and the North River, New York City, at 6:35 p. m., September 11, after an interrupted flight over an all-water route from Chicago, believed he had established a distance record for commercial flying boats. He said 7,491 miles was covered in 102 flying hours.

Bruno, D. G. Richardson, pilot, and R. E. Greisinger, mechanic, left New York on July 7 in a flying boat equipped with a 400-horsepower Liberty motor. They arrived in Chicago on August 1, made a side trip to Lake Superior and started on their return from Chicago on August 18. The machine on the return was flown along the American shore of Lake Ontario, while on the outgoing trip it had hugged the Canadian shore. The return trip was uneventful except for rain, which delayed the departure from Albany.

Chambers of Commerce in Eric, Pa., Petoskey, Charleroix, Manistee, Traverse City, Muskegon, in Michigan, and Chicago, Mr. Bruno said, had promised to co-operate with the Aeromarine Corporation in the establishment of airports in their cities.

Virginia Landing Field

There is a good emergency landing field one quarter mile east of Bluemont, Va.

The field is rectangular in shape, 400 yards long north-east-southwest, and 200 yards wide, with short side parallel with the road to Bluemont.

The field is a pasture, slightly rolling in the center, and landing should be made slowly. Gas and oil can be obtained at Bluemont.

Elucidation

We are in receipt of the following letter from Lawrence B. Sperry, of the Lawrence B. Sperry Aircraft Company, which is self-explanatory:

My attention has been called to the paragraph in your issue of August 22nd, page 571, headed, "Turn Indicator Being Used."

One would gain the impression from reading this paragraph that the Pioneer Instrument Company are the originators and developers of the Turn Indicator, and further than that, that their instrument was used by Lieut. VanZandt on his flight from Moundsville to Washington.

I would like to call your attention to the fact that the Sperry Gyroscope Company were the originators of the Gyroscopic Turn Indicator, and that we as their sole licensees have been carrying this work on for some time.

We have sold a quantity of an improved model of this Turn Indicator to the Army and quite a few civilians. The Indicator used by Lieut. VanZandt was one of ours.

We trust you will see fit to take whatever steps you deem advisable to gracefully rectify the impression given in this paragraph.

Gallaudet Secures Prizes

As a result of proposals and models submitted to the United States Army in accordance with its specifications, The Gallaudet Aircraft Corporation has been awarded the following cash prizes for the most practical types of aeroplanes: $3,000 for type 8B two-seater night observation aeroplane; $3,000 for type 10 corps observation aeroplane; $7,500 for type 13 multiseater, night bombardment aeroplane.

Field at Saratoga Springs

A municipal aviation field has been established at Saratoga Springs, N. Y.

The field is located about three miles north of the city, within easy walking distance of a trolley running into the city. The field is marked by a 10 ft. circle and the initial "S. S." The ground is level and well adapted for use of large as well as small planes. There is a gasoline station located on one corner of the field, and the spacious club house of the McGregor Links is a few hundred yards distant from the field. The field is open to all visiting aviators.

The Wadsworth Bill

(Concluded from page 32)

involving aircraft, airdromes, and air stations, their owners, lessees, charterers, and operators licensed hereunder with the right of appeal as in other cases. The law and procedure to be applied in determining such claims or controversies wherever arising, whether on land, water, or in the air, shall conform as nearly as may be to the principles of law and procedure applied in cases of admiralty jurisdiction. The owners, lessees, charterers, and operators of such civil aircraft, airdromes, and air stations, shall be entitled to the same measures of exoneration from the limitation of liability as are provided for the owners, lessees, charterers, and operators of vessels by section 4281 to 4286, both inclusive, of the Revised Statutes of the United States, section 18 of chapter 121 of the Act of Congress of June 26, 1884, and the Acts amendatory thereof and supplemental thereto; and the rules of the Supreme Court of the United States and of the inferior United States courts relating to limitation of vessel-owner's liability as now in force or as may be hereafter promulgated shall be applicable to claims and controversies involving such aircraft, airdromes, and air stations, their owners, lessees, charterers, and operators.

Sec. 16. That all salaries provided herein and all expenses incurred under the provision of this Act shall be paid out of such money as may be appropriated therefor by Congress.

Sec. 17. That if any portion of this Act be declared invalid it shall not affect any of the other portions thereof which other portions shall continue in full force and effect.

Sec. 18. This Act shall take effect from and after the date of its passage, and all Acts or parts of Acts inconsistent herewith are hereby repealed.

COX-KLEMIN REBUILDS STANDARD WITH MERCEDES MOTOR

A Standard J-1, has been recently rebuilt by the Cox-Klemin Aircraft Corporation, of College Point, L. I., N. Y., with a six cylinder Mercedes motor, as a three seater plane.

This is perhaps the first time that a Mercedes motor has been installed in a Standard J-1, and the resulting ship is a highly satisfactory one.

The Mercedes, 6 cylinder vertical motor, is rated at 160 H.P., at 1250 R.P.M., but turns up 1550 R.P.M., at full throttle, and delivers close to 200 H.P. at this motor speed. This large power gives the ship a great range of speed, maximum speed considerably more than 90 M.P.H., fast climb and tremendous reserve of power, with slow landing speed and perfect stability and balance. The Mercedes-Standard is a most useful all-round ship, suitable for the most difficult flying conditions.

Fully loaded, the machine holds altitude, and good speed at 100 R. P. M., so that it is very suitable for economical cross-country flying.

The balance is perfect, the increased stagger of the upper wing taking care of the weight of the Mercedes motor.

Ample cooling surface is provided by two side radiators.

On a plane now being rebuilt, the motor is cowled in, giving the ship a more streamline appearance.

Two passengers are placed in the front cockpit, and dual control can be provided when seats are slightly staggered.

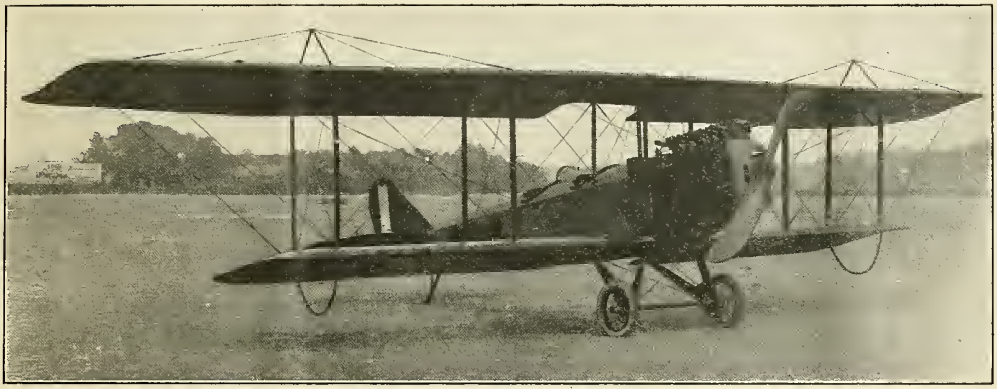
The photograph shows a front view of the machine, and the close-ups the engine mounting.

Mr. H. E. Dake, a pilot of the Mayer Aircraft Corporation, purchasers of the machine, flew the machine from Long Island to Pittsburgh. The pilot's report after test read as follows:

"I have flown and tested the Standard J-1 plane with Mercedes motor, assembled for Mayer Aircraft Co., by the Cox-Klemin Aircraft Corp., and have found same to be in excellent condition. The ship took off in a very short distance, and climbed fast at full throttle.

"Engine turned 1,550, wide open, with ship level, and 1,450 to 1,500 on steep climb. Due to abundance of power, the ship climbs well at 1,300 R.P.M. and will hold her altitude when loaded, at 1,100 R.P.M.

"With the exception of a slightly excess vibration at full throttle, which is easily remedied, I found the ship to be in perfect condition, a steep climbing, high speed, slow landing plane."



SENATOR WADSWORTH INTRODUCES BILL TO REGULATE FLYING AND DEVELOP AMERICAN AVIATION

SENATOR James W. Wadsworth, Jr., Chairman of the Military Affairs Committee, has introduced a bill (S.2448) to create a Bureau of Civil Aeronautics in the Department of Commerce and to regulate the operation of civil aircraft in interstate and foreign commerce.

Immediate passage of this bill is imperative for reasons of public safety, national security and the improvement of transportation. It is the first step necessary toward the proper advancement of American aviation.

According to a survey made especially for Secretary of Commerce Herbert Hoover by the Manufacturers' Aircraft Association, the 1,200 commercial planes in operation flew a total of 3,250,000 miles in the first six months of 1921. But during this period there were forty serious accidents, resulting in death to fourteen persons and injury to fifty-two. Practically all of the fatalities and most of the injuries might have been prevented through proper regulation.

Commercial aviation, according to the expressed views of the President and the chiefs of the Army and Navy Air Services, and members of Congress of all parties, must be developed to provide a reserve in production on facilities and primary trained personnel from which the military can draw.

It is recognized that commercial aviation, properly encouraged, will provide not only the much-needed reserve for national security, but will contribute greatly to the quickening, the improvement and the cheapening of transportation.

Just as the hazard of such flying as there is today can not be reduced without regulation, so commercial aviation, as an economic factor and military reserve, can not be developed without the establishment of the proper Federal authority.

So pertinent has the subject become that the American Bar Association, at its recent annual meeting, in considering regulatory legislation, urged that such laws as Congress enacts be framed so as to come within constitutional authority. Fortunately the bill introduced by Senator Wadsworth (S. 2448) meets these requirements, as it was framed after careful study of the preliminary report of the Committee on Aviation Law of the American Bar Association, which report anticipated the thought of the National Convention. The bill provides for a Commissioner of Civil Aeronautics, appointed by the President, operating under the Secretary of Commerce. The commissioner's duty shall be: (1) to inspect the design and construction, and, if approved, to license the operation of civil aircraft; (2) to regulate navigation and operation of civil aircraft through the establishment of aerial traffic rules; (3) to promote civil aviation by designating, approving and laying out air routes, encouraging the establishment of landing fields and air stations, by operating weather stations in conjunction with other bureaus, creating communication and signalling systems and by collecting and disseminating information concerning aviation here and abroad; (4) to encourage and undertake research and co-operate with other institutions in that work; (5) to operate such air services as the Department of Commerce may see fit.

In introducing the bill, Senator Wadsworth stated:

"This bill provides for the control, regulation and development of civil aviation. In line with the recommendations made by President Harding in his inaugural message, it establishes a Bureau of Aeronautics in the Department of Commerce, thus providing commercial flying with a centralization already possessed by the Air Services of the Army and Navy. Through control, regulation and development, civil aviation can make a real contribution to our transportation needs, particularly in the carriage of mail, and at the same time provide an economical and indispensable reserve for the military and naval services. This bill was prepared in response to the urgent solicitation of a score of organizations throughout the United States representing the operating, engineering, constructing, commercial and sporting elements in aviation. Its early enactment is imperative as a means of saving life and property, aiding our economic development and strengthening our national defense."

The bill is now before the Senate Committee on Commerce. Its immediate passage is imperative.

Following is the Wadsworth Bill:

A BILL

To create a Bureau of Civil Aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby established in the Department of Commerce under the jurisdiction of the Secretary thereof a bureau to be known as Bureau of Civil Aeronautics.

Sec. 2. That a Commissioner of Civil Aeronautics shall be at the head of such bureau, who shall be appointed by the President by and with the advice and consent of the Senate, who shall receive a salary of $7,500 per annum. There shall be also an Assistant Commissioner of such bureau who likewise shall be appointed by the President by and with the advice and consent of the Senate, who shall receive a salary of $5,000 per annum. The Assistant Commissioner shall perform such duties as may be prescribed by the commissioner or as may be required by law. There shall be also a chief clerk of said bureau, and such other deputies, assistants, and employees, as may be required from time to time and as may be authorized by law.

Sec. 3. That it shall be the duty of the Commissioner of Civil Aeronautics in conformity with the provisions of this Act—

(a) To inspect the design and construction and, if approved, to license the operation of civil aircraft, in order to safeguard life and property.

(b) To regulate the navigation and operation of civil aircraft through the establishment of aerial traffic rules and regulations in order to safeguard life and property.

(c) To foster civil aeronautics—(1) by designating, approving, mapping, and laying out air routes; (2) by establishing and encouraging the establishment of landing fields and air stations; (3) by establishing and operating meteorological services in co-operation with the other departments of the Government; (4) by establishing and operating communication and signalling systems; (5) by studying the development of aeronautics in the United States and other countries and by the collection and dissemination of information relative thereto.

(d) To encourage or undertake such aeronautical investigations and research as may be of value and to co-operate with other institutions to that end.

(e) To co-operate through proper governmental channels with the air staffs or other authorities of foreign governments, for any purpose pertaining to civil aeronautics.

(f) To operate such air services as the Secretary of Commerce may deem necessary for inspecting, licensing, regulating, and controlling the operation of civil aircraft and the mapping and laying out of air routes and airdromes and air stations and the policing thereof.

(g) To establish and administer regulations in conformity with and carrying into effect international aeronautical agreements and treaties.

Sec. 4. That, subject to the approval of the Secretary of Commerce and for the purpose of making effective the provisions of this Act, the Commissioner of Civil Aeronautics shall by regulation provide for—

(a) Licensing pilots and such other persons engaged in the navigation or operation of civil aircraft as may be required for the public safety and when necessary the suspension or revocation of such licenses.

(b) The registration, identification, inspection, certification, or licensing of all civil aircraft and when necessary the suspension or revocation of such licenses.

(c) The registration, identification, inspection, certification or licensing of all civil airdromes or air stations and when necessary the suspension or revocation of such licenses.

(d) The conditions under which civil aircraft may be used for carrying and transporting persons or property, or for the operation of any civil aerial service whatsoever, and the licensing of any such service.

(e) The prohibition of the navigation of civil aircraft over such areas as may be specified for military, naval, postal, or other purposes, either temporarily or permanently, and either absolutely or subject to such exemptions or conditions as may be prescribed.

(f) The manner of using air routes and the utilization of air navigation facilities and appurtenances.

Sec. 5. That all rules and regulations authorized under the provisions of this Act shall be formulated by the Commissioner of Civil Aeronautics and they shall then be recommended to the Secretary of Commerce and upon the latter's approval such rules and regulations shall be promulgated by him and shall have the effect of law and be enforceable from the date of such promulgation unless otherwise provided therein. The Secretary of Commerce, upon similar recommendations, shall have the power to amend, alter, suspend, or revoke such rules and recommendations and to promulgate new rules and regulations from time to time.

Sec. 6. That, subject to the approval of the Secretary of Commerce, the Commissioner of Civil Aeronautics shall co-operate with other departments of the Government to establish the conditions under which persons may be carried and property imported and exported in civil aircraft, from, into, or through the United States, its Territories and dependencies, and to prescribe the areas within which aircraft entering the United States, its Territories and dependencies or the waters thereof, are to alight and the conditions to be complied with by such aircraft.

Sec. 7. That the word "aircraft" as employed in this Act shall embrace every type of flying machine, conveyance, or vehicle now known or hereafter invented, devised, or developed, whether or not used in the carriage or transportation of persons or property, or without persons or property, flown, operated, or navigated in or through the air, and shall include aeroplanes, hydroplanes, seaplanes, balloons, dirigible balloons, and all similar conveyances or vehicles.

Sec. 8. That it shall be unlawful to fly or to navigate or operate any civil aircraft in violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, or to fly or to navigate or operate any civil aircraft in interstate or foreign commerce, or in, over, upon, or along or through navigable streams, rivers, or waters, or post roads or routes of the United States, or the air or atmosphere above the same, or in, over, or through the District of Columbia, the Territories, dependencies, reservations, national parks or over any place or building over which the United States has jurisdiction, or to maintain or operate any airdromes or air station over which the Bureau of Civil Aeronautics may exercise jurisdiction except in conformity with the provisions of this Act and such rules and regulations as may be promulgated pursuant thereto.

Sec. 9. That any violation of the provisions of this Act, or of any rule or regulation promulgated in conformity therewith, shall be punishable by a fine not exceeding $1,000 or by imprisonment for a term not exceeding one year, or both.

Sec. 10. That the provisions of this Act and the rules and regulations promulgated thereunder shall not apply to individuals, aircraft, or airdromes, or air stations under the control of other departments of the United States Government, except where use is made by the personnel or aircraft of such departments, of equipment, airdromes, or facilities licensed and controlled by the Commissioner of Civil Aeronautics, in which instances the rules and regulations promulgated by the Commissioner of Civil Aeronautics shall be observed.

Sec. 11. That the Commissioner of Civil Aeronautics and such deputies as he may designate shall have power to conduct hearings, to subpoena witnesses, to send for documents and other papers, to administer oaths, and to take such testimony as may be necessary in determining the qualifications of individuals for licenses or registration certificates to operate aircraft, airdromes, or air stations, or in the suspension or revocation of such licenses or registration certificates, or to enable him, or them, to make effective any of the provisions of this Act, or any rule or regulation promulgated in conformity therewith.

Sec. 12. That the Commissioner of Civil Aeronautics is authorized, subject to the approval of the Secretary of Commerce, to fix the fees and charges for such inspection, registration, and licensing authorized by this Act, which fees and charges shall be collected by the Commissioner of Civil Aeronautics and covered into the Treasury of the United States to the credit of miscellaneous receipts.

Sec. 13. That the Commissioner of Civil Aeronautics shall prepare and keep available at all times an up-to-date comprehensive survey and inventory of all of the civil and industrial aeronautical resources within the United States, its Territories and dependencies or the waters thereof, and shall publish quarterly a bulletin setting forth all licenses issued, together with field reports of all flying activities, accidents, and field and route data, under the control of the bureau.

Sec. 14. That the Commissioner of Civil Aeronautics shall annually, at the close of each fiscal year, make a report to the Secretary of Commerce, giving an account of all moneys received and disbursed by him and describing the work done by the bureau, and the Secretary of Commerce shall transmit such report to Congress with the annual report of the Department of Commerce.

Sec. 15. That the district courts of the United States shall have exclusive jurisdiction over all claims and controversies

(*Concluded on page* 30)

THE EMPLOYMENT OF AIRSHIPS FOR THE TRANSPORT OF PASSENGERS

Indications on the Maximum Limits of Their Useful Load, Distance Covered, Altitude and Speed*

By UMBERTO NOBILE
Director of Italian Aeronautical Construction

(Concluded from last week)

26.—Determination of the Minimum Cubature Required For a Given Trip

The data of the problem are: the number of passengers, n_o, and the distance L_o, to be covered without landing.

In round figures we may take 100 k for the weight of each passenger, comprising therein his part of the weight of the cabin and cabin fittings and also his part of the foodstuffs.

Then, taking V as the unknown cubature, we shall have:

$$\frac{1}{100}\left[f\,V - \alpha\,V^{1/3} - \beta\,V^{2/3} - \gamma\,V - \delta\,V^{4/3} - \frac{L_o}{B\,V^{2/3}} \right] = n_o$$

putting more briefly:

$$B = \frac{A}{100}\,\frac{k}{\eta}\,v^2$$

The preceding equation solved for V, gives the required cubature in function of L_o and n_o.

We may now ask what value of V renders n_o maximum, the value of L_o being established.

Solving the first member of the equation and taking it as equal to zero, we find:

$$f\,V = \frac{1}{3}\,\alpha\,V^{1/3} + \frac{2}{3}\,\beta\,V^{2/3} + \gamma\,V + \frac{4}{3}\,V^{4/3} - \frac{2}{3}\,\frac{L_o}{B\,V^{2/3}}$$

If we compare this equation with equation (4), we see, as we might have anticipated, that the volume V for which n_o is maximum, is always less than that for which Φ is maximum and that the difference of volume between n_o max. and Φ max. is less as the distance L_o is shorter. We may, therefore, deduce that for small values of L_o, the value of V corresponding to n_o maximum is greater than the cubature of minimum consumption. In other words, this cubature cannot, in general, be considered as a limit cubature, as might appear at a first glance.

The use of tables and diagrams gives a rapid solution of the problem, as we shall show by a few examples.

1st. Let us consider the transportation of 100 passengers (weight, 10,000 kg.) in a non-stop flight from Rome to New York, (distance about 7200 km.).

From the table we find that it is not possible to use airships having a maximum velocity of 120 km/h., and still less those of 150 km/h. We will therefore suppose that we have $v = 90$ km/h., and consequently v_o, normal velocity of navigation, equal to about 71.5 km/h.

Glancing at the table, we may conclude that the required cubature (certainly greater than 60,000 cubic meters since for this value we have $L_{max} = 7231$ km.) is comprised between 100,000 and 150,000 cubic meters. In point of fact, we have:

for 100,000 m³ $\Phi - c\,L_o = 5{,}800$ kg.
for 150,000 m³ $\Phi - c\,L_o = 12{,}380$ kg.

Considering that we must have: $\Phi - c\,L_o = 10{,}000$, by a simple interpolation we at once obtain:

$$V = \backsim 132{,}000 \text{ m}^3$$

The number of passengers which can be carried over the distance stated above by airships verying in cubature from 60,000 to 350,000 m³, is as follows:

$V = 60{,}000$ $n_o = \backsim 1$
$V = 100{,}000$ $n_o = 58$
$V = 150{,}000$ $n_o = 124$
$V = 200{,}000$ $n_o = 182$
$V = 250{,}000$ $n_o = 230$
$V = 300{,}000$ $n_o = 270$
$V = 350{,}000$ $n_o = 300$

2nd. In the previous case, suppose that we make a stop at the Azores for the purpose of taking in fuel. Under these conditions the maximum distance is reduced to about 3,700 km., and the cubature for $v = 90$ km/h., to 45,000 m³, instead of 132,000 as in the first case.

3rd. Let us consider the line London-Paris-Marseilles-Rome-Naples-Taranto-Cairo, with stops at London, Rome, Taranto and Cairo.

There will be non-stop flights having the following lengths:

London-Rome	1625 km.
Rome-Taranto	460 km.
Taranto-Cairo	1700 km.

Adopting airships of 120 km/h., we find that with a cubature of 50,000 m³ we can carry 80 passengers, and with a cubature of 100,000 we can carry 200 passengers, covering the entire distance in about 40 hours' flight.

4th. Suppose we have a passenger service between Milan in Italy and Alexandria in Egypt (distance about 2,400 km.) operated by airships having a maximum velocity of 120 km/h. and a normal velocity of 95 km/h.

For a non-stop flight, we have at once from the table:

for 40,000 m³ $n_o = 17$
for 60,000 m³ $n_o = 55$
for 80,000 m³ $n_o = 93$

But suppose that we make a stop at Taranto (Milan-Taranto, 875 km.; Taranto-Alexandria, 1525 km.), the maximum distance to be covered in a non-stop flight is reduced from 2,400 to 1,525 km. and we have:

for 40,000 m³ $n_o = 59$
for 60,000 m³ $n_o = 118$
for 80,000 m³ $n_o = 169$

Conclusions

1. The results we have reached in this investigation fully confirm the essential points characterizing the airship: a flying machine relatively slow, but capable of carrying a large useful load over a long distance.

These characteristics are the contrary of those of the aeroplane, which, in the present state of aerial technical data, is a machine essentially fast, but which can only carry a relatively small useful load over a relatively short distance.

There is, therefore, no reason to talk about competition between these two means of aerial locomotion, since they are so essentially different from each other, each having its own definite field of activity, the one serving to complete the other. The co-existence of airships and aeroplanes forms a complete solution of the problem of aerial navigation.

The advantages of airships of large cubature are so evident as to justify the greatest hopes for their immediate future. It should be remarked that it is not too much to hope that the limits we have found, and which are already pretty large, will be exceeded in actual practice, since in our investigation we have abstained from considering the developments which may confidently be expected from the genius of inventors and the skill of constructors.

Even without taking these probable developments into account, though they are by no means negligible quantities, we see that there is a certain limit to the advantages of large cubature.

This limitation is due, essentially, to the gradual decrease of the coefficient of utilization and *consequently of the maximum altitude of flight.* By increasing the cubature beyond the point corresponding to ρ maximum, (which our calculations show to be much smaller than is commonly believed), the maximum altitude of the airship goes on decreasing, in spite of the fact that the range of action in a horizontal plane and the useful load go on increasing.

Now, the possibility of rapid climb is undoubtedly an essential factor of security of aerial navigation in the case of storms.

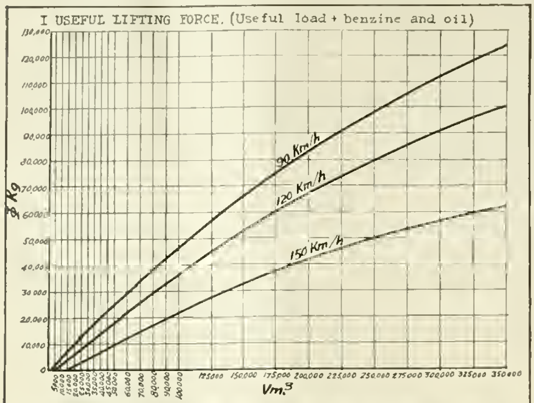
The other factor of security is velocity. To run ahead of a storm is another way of avoiding it.

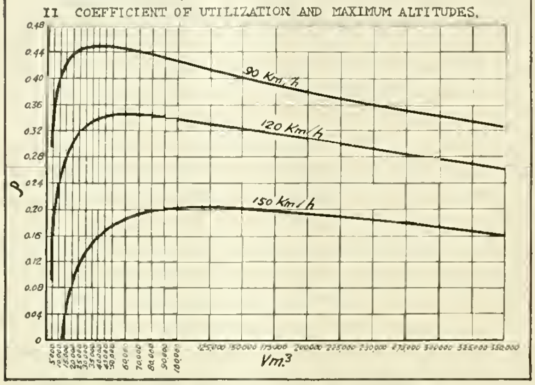
High altitude and high speed are, however, antithetical terms. It it possible to build airships capable of rising to high altitudes, but they will, necessarily, have low velocity, just as it is possible to build airships having high speed, but having a low ceiling.

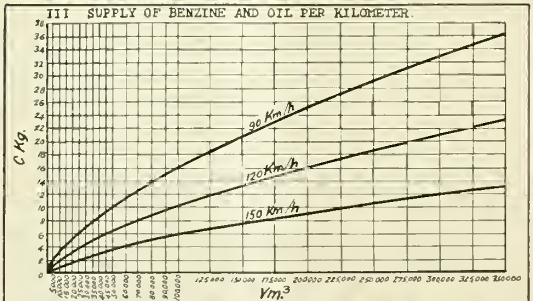
Our investigation leads us to conclude that a maximum velocity of 120 km/h. is as far as we ought to go. This figure can only be exceeded by excessive reduction of altitude of ceiling, range of flight, and useful load.

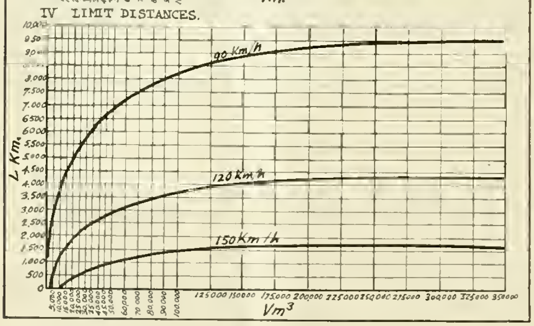
Now, at 120 km/h., for a cubature of 200,000 cubic meters, we have a coefficient of utilization of 0.31, which, including the 300 m. of initial rise, corresponds to a ceiling of about 4,000 m. altitude, reached, however, with a zero useful load and at the end of the flight only, after having consumed the entire supply of benzine and oil. This ceiling is evidently of relatively low altitude, and we should therefore consider the advisability of exceeding the above given cubature for airships of this type.

Of course, with decreased velocity there would be an improvement. For instance, with the same cubature of 200,000 cubic meters and a speed of 90 km/h., the ceiling would be at about 5,000 m. The gain in altitude would not, however,


I USEFUL LIFTING FORCE. (Useful load + benzine and oil)


II COEFFICIENT OF UTILIZATION AND MAXIMUM ALTITUDES.


III SUPPLY OF BENZINE AND OIL PER KILOMETER.

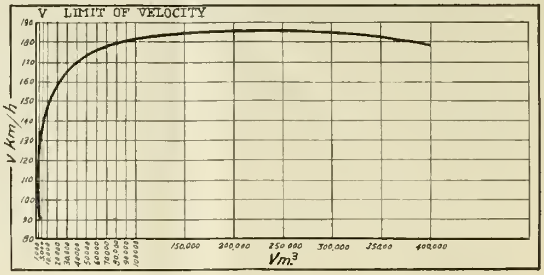

IV LIMIT DISTANCES.

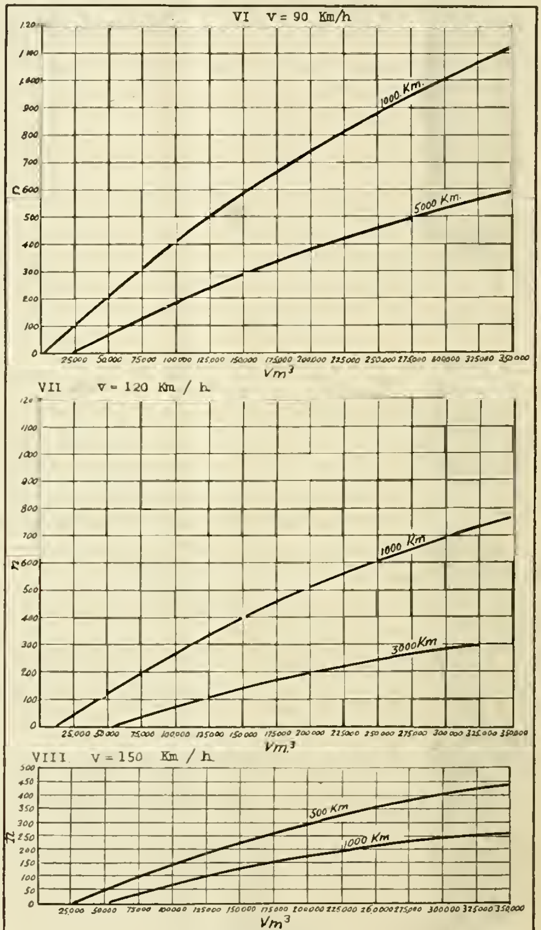
altogether compensate for the pronounced decrease of maximum velocity.

2. We will now consider the use of the airship in a public passenger service.

The essential requisites of a public transport service are safety and regularity of service.

The first of these requirements can undoubtedly be met. We have only to adopt a cubature large enough for realizing the following three conditions: (a) the certainty of being able to rise rapidly to a height of 1500 or 2000 m. right at the beginning of navigation; (b) a fuel reserve sufficiently ample to enable the ship to sail for much longer than the anticipated time, should this be required by the atmospheric conditions; (c) the possibility of developing a relatively high maximum speed.


V LIMIT OF VELOCITY



VI - VII - VIII - INFLUENCE OF LENGTH OF FLIGHT ON NUMBER OF PASSENGERS:

When these three conditions are satisfied we may say without fear of exaggeration that *aerial navigation by airships is safer than maritime navigation.* As a matter of fact, a ship on the water cannot rise above the gale as an airship can.

The necessity of satisfying all three conditions at the same time, leads us to conclude, on the basis of our calculations, that under the present conditions of aerotechnics it is not advisable with airships used for passenger service, to exceed a normal flying speed of 80 or 90 km/h. or a non-stop flight of more than 3000 to 4000 km. In other words, we are convinced that the best cubature to adopt is not that which aims at increasing the length of non-stop flights or of the speed of flight, but rather that which aims at safety in navigation by increasing the supply of benzine and the amount of ballast.

The requisite of regularity, meaning thereby starting and arriving at schedule time, is, for the airship, intimately connected with the question of safe navigation, since, when this is assured we may, in a large measure, count on the flight being accomplished within the stated time. It cannot, however, be denied that, aerial navigation being still largely dependent on atmospheric conditions, a strict adherence to schedule time can only be guaranteed if the service is limited to the most favorable season of the year, though it may be remarked that the regularity of the maritime service is also influenced by weather conditions in a certain measure.

We may hope that airships will be much less affected by weather conditions when, in the near future, the problem of mechanical mooring, housing, and getting the ship out of its hangar, has been satisfactorily solved.

3. It is thus possible to assure an airship service offering the most absolute guarantees for security of flight and also, within practical limits, regularity of service. We must now consider the question from the economical point of view.

We do not deem it necessary to enter here into an analysis of the unit cost of aerial transportation, but we may certainly affirm that, in most cases, the cost of aerial transport will necessarily be greater* than transport by land or water, especially when, as in a public service, satisfactory regularity and absolute safety are required.

But in judging the economical aspect of transportation, we must consider not only cash outlay, but also another essential factor, namely, speed.

Considering the question from this point of view, we shall not be so foolish as to pretend that the airship competes with the railway or motor-car unless (and such cases are not rare) over difficult or mountainous country or where business is limited. In these cases the aerial service would show a considerable saving of time as compared with other means of transport, either on account of the airship being able to take the most direct route or on account of greater speed.

Also, we need not be surprised if in such characteristic cases the cost of aerial transport should prove to be less than the cost of transport by rail or motor-car. For instance, if the line is intended to link up two places difficult of access, far distant from each other, and having only sufficient business to warrant, say, a bi-weekly service. Under these conditions it is quite certain that the cost of establishing and running an aerial line would be much less than that of laying a railway or making routes for motor-cars.

Except for the exceptional cases just mentioned, we believe that *an aerial service with airships is especially and particularly suitable for flights over large expanses of water.*

We must here distinguish between short distance and long distance flights.

In the first case, it is evident that we can attain a high flying speed, thereby obtaining a considerable advantage over the usual maritime service, whether over seas or lakes. Such may be the case, for instance, for a line Rome-Cagliari, or Rome-Tripoli, or Rome-Palermo.

For a longer distance, we must, on account of the reasons given above, reduce our speed, but, in any case, we may take it that the journey will be completed in about half of the time required by the fastest ships.

The question now arises whether this gain in speed as compared with maritime navigation is such as to compensate for the greater cost and the inevitable decrease in comfort.

The answer to this query cannot be doubtful. When the safety of the journey is assured and there are regular departures (two conditions which, as we have seen, can be complied with) passengers will certainly not be lacking.

Concerning the question of departures at stated times, we may remark that for long journeys over the sea, punctuality in leaving according to a pre-aranged time-table is of less importance than for short journeys. That is to say, the departure of an airship need not be announced much ahead of the time, nor need the departures be arranged according to a fixed time-table. It will be sufficient if the time of departure is announced two or three days beforehand, so as to give intending passengers time to prepare, and to decide whether they will travel by air or by the usual maritime service. This consideration is of some importance, since it meets the objection raised that aerial transport being, as it is, dependent on the weather, cannot compete commercially with maritime navigation.

4. *The airship for tourists.*

In this field the airship has a unique position, surpassing even the aeroplane. The airship tourist service cannot fail to develop and flourish since it requires only a small capital and combines large profits with absolute security of investment.

Such a service is especially important in countries like Italy, where there is always a great influx of visitors from abroad. We are convinced that a well organized system of touring airships, especially in tourist centers, would not only be successful from an investor's point of view, but would also react favorably on the general economic conditions of the country.

The following considerations justify the theory that a tourist service with airships is capable of being developed under the most favorable conditions.

1st. The sensation of absolute security given by an airship in comparison with that felt in other modes of flight, cannot fail to attract a large number of tourists.

2nd. For passenger transport the airship offers much greater convenience and comfort than the aeroplane; also, the airship can slow down during flight or even remain stationary in the air, thus allowing greater enjoyment of the panorama.

3rd. The risks of navigation are reduced to a minimum, or even altogether eliminated, since the tourist service will only operate in suitable weather.

4th. The cost of terminal stations, material and personnel are reduced to a minimum, especially for short distance flights such as Rome-Naples, Bay of Naples, the Italian Riviera, Sicily, etc. For longer flights, such as Rome-Constantinople, Rome-Cairo, Rome-Paris, etc., these items will amount to more.

5th. Considering the class of passengers who will be catered for, the rates charged may be fixed at a sufficiently remunerative figure.

5. *Rigid and semi-rigid airships.*

We will conclude this study by a rapid comparison between the two types of airships which are today contending for supremacy: the semi-rigid Italian type and the rigid German type.

Of the Italian semi-rigid type there are two classes, one having an articulated longitudinal beam, the other, a rigid longitudinal beam.

While for small cubatures, the absolute superiority of our articulated beam type is generally recognized (and proved by the numerous requests from foreign Governments for sample airships of this type and the appreciations of them expressed in the official organs of those Governments,*) many experts and especially many amateurs maintain that, even for large cubatures, the Italian semi-rigid type can successfully compete with the German rigid type.

Though there may be a doubt in the matter as regards the articulated type, there can be none whatever as regards the rigid type, as shown by the brilliant success of our experience with our first T type airship. We are convinced that to whatever dimensions our T type may be increased (within the limits suggested in this study) we shall always find that the particular characteristics which constitute its fundamentally good qualities are not only preserved, but even accentuated.

Of course, we do not say that great increase of cubature can be made without giving rise to difficulties. When the cubature exceeds 100,000 cubic meters the problems of construction and assemblage take on a certain importance, but though these problems may be difficult of solution they are never such as to lead to unfavorable conditions.

We consider that the essential reason why our type is superior to the German, lies in the conception of the rigidity itself. In the German type, the whole of the external surface is made rigid, even where the natural pressure of the gas is sufficient to preserve the shape. The Italians only make rigid those parts which really require such treatment, thus greatly simplifying construction and assembling which more than compensates for the slight disadvantage of a less penetrating form. Moreover, as regards the preservation of the form, the rigid type does not appear to have much advantage over the Italian semi-rigid, since, with the rigid bow of the T type the excess pressure of the gas in the envelope can be maintained relatively low, without fear of any inconvenience arising either during navigation or during mooring operations.

The superiority of the Italian conception appears, however, not merely in simpler construction, but also, and more especially, in greater strength. This is evident when we compare the *huge, delicate, fragile arrangement* formed by the metallic framework of the Zeppelins with *the strong, elastic backbone* formed by the longitudinal beam of the Italian type. This backbone is *strong* because its parts, being relatively small and exposed to great forces, have a resistance which we shall

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*And greater generally with aeroplanes than with airships. This statement may seem, at first sight, rather paradoxical, but it can easily be proved by even a summary analysis of the cost of transport.

*Our Aeronautical Construction Works has just completed an M type airship for England, and two O types, one for the U. S. A., the other for the Argentine. Another of the same type is being built for Spain. The O type, derived from the P type, (Crocco-Riccaldoni) may be considered as the most successful of Italian small cubature airships. It was designed by Engineers Pesce and Nobile.

TABLE I.

Weight of the Various Parts of the Airship in Function of Volume and Speed

$$P = V^{1/3} + (\beta' + \beta'' v^3) V^{2/3} + (\gamma' + \gamma'' v^2) V + \delta V^{4/3}$$

(P in kg.; V in m.^{3}; v in km/h.)

Parts	$\alpha V^{1/3}$	$\beta V^{2/3}$	
		β'	$\beta'' v^3$
Envelope with all accessory organs including valves and valve controls.		2.410	
Stiffening of bow			
Stabilizers and rudders with controls			
Longitudinal Beam			
Accessories of longitudinal beam (covering, gangway, shock absorbers)		0.374	
Power plant with supports			10^{-6} 3.15 v^3
Maneuvering devices			
Plant for lighting, wireless, ventilators	4.5	0.190	
Pilot's cabin		0.300	
Crew	20.0		10^{-6} 0.20 v^3
Engine spare parts and tools			10^{-6} 0.16 v^3
Reserve ballast and ballast for initial climb of 300 m.			
	α = 24.5	β' = 3.274	β'' = 10^{-6} 3.51

TABLE I. (Cont.)

Weight of the Various Parts of the Airship in Function of Volume and Speed

$$P = V^{1/3} + (\beta' + \beta'' v^3) V^{2/3} + (\gamma' + \gamma'' v^2) V + \delta V^{4/3}$$

(P in kg.; V in m.^{3}; v in km/h.)

Parts	γV		$\delta V^{4/3}$
	γ'	$\gamma'' v^2$	
Envelope with all accessory organs including valves and valve controls	0.008		0.00374
Stiffening of bow		10^{-6} 1.3 v^2	
Stabilizers and rudders with controls	0.047		
Longitudinal Beam	0.022	10^{-6} 0.5 v^2	0.00236
Accessories of longitudinal beam (covering gangway, shock absorbers)			
Power plant with supports	0.003	10^{-6} 1.3 v^2	
Maneuvering devices			0.00060
Plant for lighting, wireless, ventilators	0.007		
Pilot's cabin			
Crew	0.003		
Engine spare parts and tools			
Reserve ballast and ballast for initial climb of 300 m.	0.070		
	γ = 0.160	γ'' = 10^{-6} 3.1	δ = 0.0067

seek in vain in the framework of the Zeppelin. It is *elastic*, because its articulated joints, the peculiar characteristic of our longitudinal beam, give it an elasticity which enables the airship to withstand shocks and bumps, while the Zeppelin, as experience has proved, cannot support such shocks without serious damage.

These are the two most important advantages of the Italian type over the German type. We may also mention the following:

TABLE II.

Maximum Velocity, 90 km/h.

Normal Velocity of Flight, about 72 km/h.

Cubature V m³	Useful lifting force (for f = 1100 kg/m.³ Φ kg.	Coefficient of utilization ρ	Fuel and oil per km. c kg.	Limit distance L km.	No. of passengers for 1000 km.	No. of passengers for 5000 km.
5,000	1,877	0.3411	0.772	2,431	11	0
10,000	4,472	0.4005	1.226	3,647	2	0
15,000	7,095	0.4300	1.606	4,418	55	0
20,000	9,700	0.4409	1.946	4,985	77	0
25,000	12,275	0.4463	2.258	5,436	100	0
30,000	14,813	0.4489	2.550	5,809	123	21
35,000	17,312	0.4497	2.826	6,126	145	32
40,000	19,775	0.4494	3.089	6,402	167	43
45,000	22,202	0.4485	3.341	6,645	189	55
50,000	24,589	0.4471	3,584	6.861	210	67
60,000	29,264	0.4434	4.047	7,231	252	90
70,000	33,806	0.4390	4.485	7,538	293	114
80,000	38,226	0.4344	4.903	7,796	333	137
90,000	42,406	0.4283	5.304	7,995	371	159
100,000	46,699	0.4245	5.690	8,207	410	182
125,000	56,693	0.4123	6.602	8,587	501	237
150,000	66,083	0.4005	7.456	8,863	586	288
175,000	74,923	0.3892	8.263	9,067	667	336
200,000	83,258	0.3784	9.032	9,218	742	381
225,000	91,118	0.3681	9.770	9,326	813	423
250,000	98,541	0.3583	10.480	9,403	881	461
275,000	105,548	0.3489	11.169	9,450	944	497
300,000	112,164	0.3399	11.835	9,477	1,003	530
325,000	118,407	0.3312	12.484	9,485	1,059	560
350,000	124,299	0.3229	13,116	9,477	1,112	587

TABLE III.

Maximum Velocity, 120 km/h.

Normal Velocity of Flight, about 95 km/h.

Cubature V m³	Useful lifting force Φ kg.	Coefficient of utilization ρ	Fuel and oil per km. c kg.	Limit distance L km.	No. of passengers for 1000 km.	No. of passengers for 3000 km.
5,000	758	0.1378	1.373	552	0	0
10,000	2,654	0.2412	2.179	1,218	5	0
15,000	4,678	0.2835	2.855	1,638	18	0
20,000	6,737	0.3062	3.459	1,948	33	0
25,000	8,802	0.3200	4.014	2,193	48	0
30,000	10,858	0.3290	4.532	2,396	63	0
35,000	12,895	0.3349	5.023	2,567	79	0
40,000	14,914	0.3389	5.491	2,716	94	0
45,000	16,911	0.3416	5.939	2,847	110	0
50,000	18,881	0.3433	6.371	2,963	125	0
60,000	22,751	0.3447	7.195	3,162	156	12
70,000	26,522	0.3444	7.973	3,326	185	26
80,000	30,197	0.3431	8.716	3,464	215	40
90,000	33,691	0.3403	9.428	3,574	243	54
100,000	37,246	0.3386	10.114	3,683	271	69
125,000	45,553	0.3313	11.736	3,881	338	103
150,000	53,335	0.3232	13.252	4,025	401	136
175,000	60,629	0.3149	14.687	4,128	459	166
200,000	67,468	0.3066	16.055	4,202	514	193
225,000	73,873	0.2985	17.365	4,254	565	218
250,000	79,877	0.2905	18.630	4,287	612	240
275,000	85,496	0.2826	19.852	4,307	656	259
300,000	90,752	0.2750	21.037	4,314	697	276
325,000	95,660	0.2676	22.190	4,311	735	291
350,000	100,237	0.2604	23.314	4,299	769	303

1st. Rapidity and certainty in designing.

2nd. Rapidity of construction and utilization of materials of current use and constant characteristics.

3rd. Great rapidity and simplicity of mounting.

4th. Possibility of taking the airship to pieces rapidly either for purposes of storage or transport when it is not advisable to send it under its own power. We may note that the Zeppelin cannot be taken apart.

5th. Possibility in the future of assembling the airship outside the hangar. In fact, the assembling of our longitudinal beam complete with all its accessories, comprising the stiffening of the bow, the power plant, rudders, etc., can be done without inconvenience in the open air if it is protected from the weather by a temporary covering of limited dimensions. When the rigid part is assembled we can, given favorable conditions and fine weather, proceed rapidly to the inflation of the envelope and to its connection with the rigid part. After this, the airship may be ready in a few days, if not to fly, at least to be moored so that the final adjustments may be made without danger.

6th. Great facility of inspection and repairing of single metallic parts. This considerable advantage arises immediately from the fact that the rigid part occupies only a small space, and also that the various parts are articulated together, so that a damaged part can easily be changed.

7th. Lower cost of construction and assembling. We need not dwell on this point. Greater rapidity of construction and assembling together with the use of current materials must conduce to a lower cost of production.

This advantage, however, must be set off against the cost of operation. As a matter of fact, in the Italian type, when, from any cause, the gas bag becomes inefficient, it must be entirely renewed. It is certain that to change one of the gas compartments of the Zeppelin is a much less costly operation, but, on the other hand, when we consider that the cost of upkeep of the rigid part is much less in the Italian type, we come to the conclusion that, on the whole, the upkeep of a Zeppelin is more costly than the upkeep of an Italian airship.

In summing up all the advantages of an Italian airship over a Zeppelin, we must, however, admit that in one point the latter are superior, namely, in the coefficient of head resistance. But we are convinced that this inferiority will soon be eliminated by successive improvements in the Italian type of airships.

Rome, December, 1920.

Translated by Paris Office, N. A. C. A.

TABLE IV.

Maximum Velocity, 150 km/h.

Normal Velocity of Flight, about 119 km/h.

Cubature V m³	Useful lifting force Φ kg.	Coefficient of utilization ρ	Fuel and oil per km. c kg.	Limit distance L km.	No. of passengers for 500 km.	No. of passengers for 1000 km.
5,00	– 1,063	–0.296				
10,000	– 289	–0.026				
15,000	772	0.0468	4.461	173	0	0
20,000	1,957	0.0889	5.406	362	0	0
25,000	3,210	0.1167	6.271	512	1	0
30,000	4,496	0.1362	7.083	635	10	0
35,000	5,800	0.1506	7.848	739	19	0
40,000	7,113	0.1617	8.579	829	28	0
45,000	8,428	0.1683	9.279	908	38	0
50,000	9,735	0.1770	9.955	978	53	0
60,000	12,331	0.1868	11.242	1,097	67	11
70,000	14,883	0.1932	12.458	1,195	87	24
80,000	17,384	0.1975	13.618	1,276	106	38
90,000	19,742	0.1994	14.730	1,340	124	50
100,000	22,192	0.2017	15.802	1,404	143	64
125,000	27,850	0.2025	18.337	1,519	187	95
150,000	33,115	0.2007	20.707	1,599	228	124
175,000	37,993	0.1974	22.948	1,656	265	150
200,000	42,497	0.1932	25.085	1,694	298	174
225,000	46,638	0.1884	27.134	1,719	331	195
250,000	50,335	0.1830	29.109	1,729	358	212
275,000	53,899	0.1782	31.019	1,786	384	229
300,000	57,045	0.1729	32.871	1,735	407	242
325,000	59,883	0.1675	34.673	1,727	425	252
350,000	62,426	0.1621	36.429	1,713	442	260

THE NIEUPORT-DELAGE BIPLANE, TYPE 30-T

The Nieuport-Delage biplane, type 30.T, represents the development of the Nieuport "Berline" exhibited at the Paris Aero Show in 1919-20, which was supposed to have been used on the London-Paris airway, but so far has never arrived in this country. The 30.T. was built by the Etablissements Nieuport for participation in the Grand Prix de l'Aero Club de France, but owing to some parts of the Darracq-built Sunbeam-Coatalen engine being made in England it was disqualified under the rule that the whole of the aircraft and engine had to be of French manufacture.

The principal modifications in the 30.T. appear to consist of refinements in streamlining with a view to obtaining an economical speed, and it is claimed that a higher speed has been obtained thus with an engine of similar horse-power.

The fuselage is rectangular section, tapering to a knife-edge aft, and embodies in it, like so many commercial machines, two forms of construction. From the nose to the rear of the passenger saloon the longerons are three-ply covered, thereby leaving this portion free from obstructions. The rear half of the fuselage is built up in the usual manner and is wire braced. The duralumin engine bearers are carried on two transverse formers or bulkheads. The engine is a 420-h.p. Sunbeam-Coatalen built at the Darracq works at Suresnes (Seine). The normal b.h.p. is 420 at 2,000 r.p.m. The airscrew is a four-bladed Chauvière. Three Lamblin radiators are mounted under the fuselage between the front legs of the undercarriage.

The pilot's cockpit is situated behind the engine, the pilot being seated on the left side. Under the pilot's cockpit are the main fuel tanks, an auxiliary gravity tank being mounted in the centre section. Auxiliary and main switches, starting magneto and pumps are situated within easy reach of the pilot, so that he can start up without any assistance.

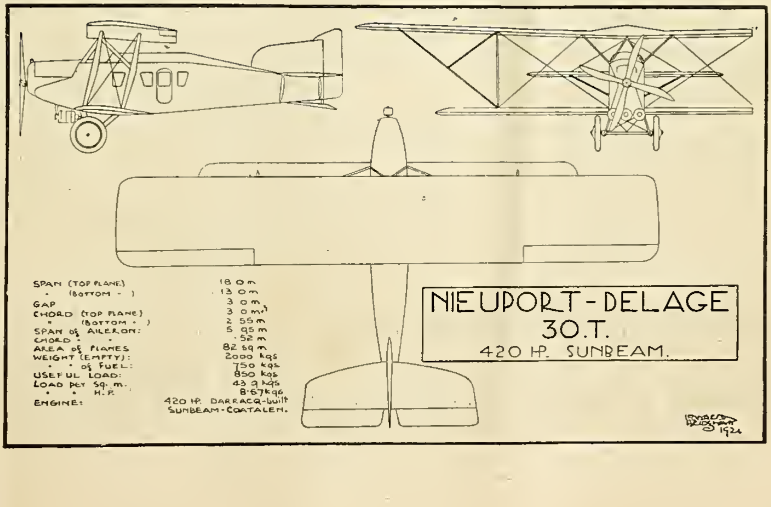
The cabin is very roomy and has accommodation for six passengers. Access to the cabin is by means of a door on the left side, a folding ladder being carried. Accommodation for a wireless operator and his instruments is made in the rear of the passenger cabin.

The undercarriage is of high tensile steel tube streamlined with wooden fairing.

The wings are of fairly thick section, the top plane having considerable backstagger. The centre section is mounted on a cabane, resembling that of the 1½ strutter, with the exception that viewed from the side the struts form the letter N. One pair of interplane struts are fitted either side of the fuselage, but owing to the top plane having considerable overhang, an additional pair of light struts run from the base of the main struts to a point about two-thirds along the overhang. These struts are braced from their centre to the top of the main struts.

Ailerons are fitted to the top plane only.

The tail unit consists of a large fixed tail plane and unbalanced elevators and a large fin and a balanced rudder.—*The Aeroplane,* Aug. 24, 1921.



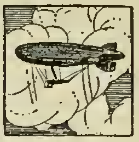
Governor Allen Flies from Philadelphia to New York

Governor Henry J. Allen, of Kansas, is now a greater advocate of aviation than ever before. A Fokker limousine machine September 12 deposited him at Mitchel Field, Mineola, after making the flight from Philadelphia in an hour.

He was the guest at luncheon of the Philadelphia Chamber of Commerce, and at the suggestion of its members made the aeroplane trip to New York. He was accompanied by V. E. Scott, A. G. Paige, George Howard and Colonel John H. Jackson.

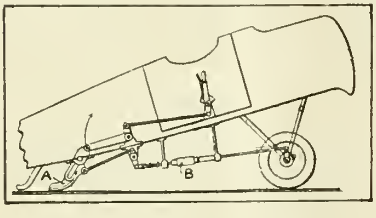
Governor Allen was pleased with the speedy trip, and said that upon his return home he would urge the establishment of air routes between the large cities of Kansas.

FOREIGN TECHNICAL DIGEST



An Automatic Brake for Aeroplanes

Among those who have been giving their attention to the subject of stopping an aeroplane in the shortest space, after it has landed, is Mr. James E. Mardon, who was led to think over the problem during the War, and has taken out a patent (No. 139,854/19) for his invention. One of the most serious difficulties in the way of fitting a brake to the wheels of aeroplanes is that of making certain that the full force of the brake cannot be suddenly applied—with disastrous results to such a fragile structure as an aeroplane. That has been the defect from which many of the designs of wheel-brakes for aeroplanes tried in the past have suffered—they tend to turn the machine over on its nose. Realizing this, Mr. Mardon has devised a scheme of brakes operating on the aeroplane wheels, in which, while the brake-lever brings the brake-system into operation, it only does that, the brake itself being gradually applied with a gradually increasing pressure through the action of a dash-pot or some similar device.



A further development of the device is shown in the drawing; here the brake is automatically applied as the machine lands. A hand brake-lever of the usual type is employed, and when it is in the "off" position the special skid A is drawn up clear of the ground, but when it is put in the "on" position this skid is lowered, so that it can make contact with the ground before the tail skid proper touches. From this it will be seen that the brakes are not applied by the movement of the lever; that only brings the brake-skid, as it may be termed, into position so that it can automatically apply the brakes on the wheels when the machine lands. In this arrangement, as in the hand-operated design, there is a dash-pot, B, which allows for the gradual application of the brake, thus preventing any violent retardation with its risk of overturning the machine. In the diagram the brake shown is of the hand variety, but it need hardly be said that the system can be adapted to any type of brake acting on the wheels. Similarly it is possible to vary the arrangement of brake-lever or to utilize other methods of putting the system in operation, according to circumstances.

—Flight.

Some Recent Farman Aeroplanes

Like most surviving aeronautical firms of long standing and experience, both in this country and in France, the Maison Farman have been turning out from time to time new or modified types of aircraft suitable either for commercial or military use. Their most noteworthy effort since the armistice is undoubtedly the "Goliath," designed towards the end of the war as an "avion de bombardement" and converted into an extraordinarily efficient passenger-carrier, as its consistent good work on the London-Paris service has demonstrated, its regularity of arrival and departure being on an equality with that very trustworthy article the cheap German alarm clock.

Quite recently the two-engined "Goliath" has been modified to take three 265-h.p. Salmson engines, the additional engine being carried in the nose of the fuselage. A machine of this type, which is a standard "Goliath" in all other respects, recently completed the tests organized by the Service Technique de l'Aéronautique.

The following performance figures were obtained in the course of these tests: Total weight 5,000 kg.; Speed at 2,000 m. 160 km.p.h.; Speed (min.) at 3,000 m., 110 km.p.h.; Useful load, 2,200 kg.; Ceiling, 4,550 m.

Of the smaller type of aircraft, the type F.70 is a single-engined biplane. It is fitted with either a 300-h.p. Renault or 265-h.p. Salmson engine, and can either be used as military machine fitted with two machine-guns, or with slight alterations as a commercial machine, for which it is fitted with a comfortable saloon for four passengers.

The type T.O.E. is similar to the F.70, but is fitted with the 300-h.p. Renault engine. In appearance it possesses most of the features common to the "Goliath," in having the same form of fuselage, the same shape of tail-unit, square-cut wing-tips, streamlined vees to the undercarriage, etc.

The 300-h.p. Renault is mounted in the nose, and has two long narrow radiators mounted one in front of each front centre-section strut. Behind the engine are carried the main petrol-tanks, and in rear of these, behind a fireproof bulkhead, is the cabin for six passengers. The pilot is situated in rear of the cabin, in a position similar to that found in the D.H.18 and the Potez IX.

The wings are of fairly thick section, and are without stagger or dihedral. One set of interplane struts are mounted on either side of the fuselage. Ailerons of unbalanced type are fitted to the top plane only. The tail-unit is conventional, all surfaces being unbalanced, but the tail plane is fitted with gear to enable the angle of incidence to be varied during flight.

The undercarriage consists of two N's of wood streamlined with three-ply, connected by a steel tube axle upon which are mounted two "Palmer" wheels, 800 by 150 mm., suspended on rubber cord.

The principal dimensions are:—

Span 13.9 m.; Chord 2.3 m.; Gap 2.3 m.; Length overall 9.4 m.; Surface 62.2 sq. m.; Weight (empty) 1,000 kg.; Weight (loaded) 2,000 kg.; Weight per h.p. 6.6 kg.; Weight per sq. m. 32.5 kg.

Since the war Farman Frères have taken over the construction of the Georges Levy flying-boats. Two of these are now being produced as Farman flying-boats, one with one 450-h.p. Renault engine, and one with three 350-h.p. Panhard engines.

The 450-h.p. boat is of the central boat-built hull type. The hull is built up of an ash framework covered with mahogany planking triple for the bottom forward and double for the sides and bottom aft. For parts of the hull upon which there is no strain, three-ply birch is employed. The hull is divided into a number of water-tight compartments. Easily detachable tanks are carried in the hull, and contain sufficient fuel for a four hours' flight at full power.

The wing cellule is of biplane form and folds backwards on the rear spar, fitting at the centre-section, the wing bracing not being interfered with during the folding operation.

The tail is of monoplane type.

The engine, a 450-h.p. Renault, is mounted on a series of ash struts and bearers, and drives an ungeared pusher air-screw. All engine controls are of direct pull-and-push type.

The wing-tip floats have a capacity of 300 litre, and are fitted with drain cocks.

This boat possesses a useful load of 1,000 kg., a top speed of 170 km.p.h., and climbs to 2,000 metres in 15 mins.

The three-engined boat has been built to the order of the French Navy, and has recently been tested at the French Centre d'Aviation at St. Raphael. The construction follows the practice found on the 450-h.p. boat.

Specification:—Span 33 m.; Length 18 m.; Surface 200 sq. m.; Chord 3.6 m.; Weight (empty) 4,500 kg.; Useful load 2,500 kg., including 500 kg. of bombs; Speed 145 km.p.h.—*The Aeroplane*, Aug. 24, 1921.

New Italian Airship

The French Government is reported to be investigating a new lighter-than-air flying machine which is under construction at Naples. Using no gas, it is based upon the principle of the lightness of rarefied air. By a variable exhaustion of air in a series of envelopes, levitation is obtained.

The machine is the invention of two Italians, Vaugeau and Gargiulo. They do not form anything like a perfect vacuum, but by a system of enclosed reservoirs, the center one of which has the greatest rarefication, they say that they have obtained the result that the pressure of the outside atmosphere is lessened to a degree which makes the frail envelope practicable.

There are three features of the construction. The first is a double envelope one part with another. In the outside envelope an atmosphere of seven-tenths is maintained, whereas in the center envelope the air is much more rarefied. The layer of seven-tenths atmosphere weakens the outside pressure upon the interior of the balloon, which exercises the levitation force.

The second feature is a series of hollow beams forming the frame of the machine, through which compressed air circulates in a manner to exert a counteracting pressure against the outside atmosphere.

The third feature makes use of air heated by the motors to obtain a further decrease of the outside pressure.

Professor Garuffa, an Italian expert, holds that the new machine means a revolution in flying. It will do away with the expense of the use of hydrogen and, it is said, will greatly reduce the crews needed.

The inventors say that the machine when perfected can make 350 miles an hour with 750 horsepower.

NAVAL *and* MILITARY AERONAUTICS

Opening of Air Service R. O. T. C. Camp

The first Air Service Reserve Officers Training Camp opened at Post Field, Fort Sill, Oklahoma, on June 16, 1921, thereby marking development in the Air Service preparedness program. There are thirty-one students at the camp, twelve from the Massachusetts Institute of Technology, five from the Georgia School of Technology, two from the Texas Agriculture and Mechanical College, seven from the University of Illinois, and five from the University of Washington. Students who are enrolled in the Air Service R. O. T. C. units at educational institutions, and who have completed two years of Air Service work are eligible for the camp if they are physically qualified to pass the medical examination to determine fitness for pilot duty.

At this advanced camp the students are taught aerial observation, and receive theoretical and practical instruction on the ground and flying experience in DH-4B planes as observers. The course of instruction lasts six weeks, and includes visual reconnaissance, radio, aerial gunnery, photography, meteorology, trap shooting, infantry drill, and calisthenics.

The administrative personnel of the camp is composed of the officers attached to the six R. O. T. C. units who have been ordered to Post Field for this temporary duty during the camp.

Air Service Reserve Unit

Enough men have been signed up in the Air Service Reserve Unit, now organized in the east bay section, to form an aeroplane squadron, photographic section and balloon company, it is announced. Those signing before the lists are finally sent in will be given an earlier consideration, and all desiring to be included in the unit have been urged to send in their names at once. Lieutenant Harvey M. Pugh, A. S. A., O. R. C., has been appointed officer, and Lieutenant James Cavagnaro, A. S. A., O. R. C., is personnel officer.

Special interest has been shown by enlisted men because of the circumstance that members of the squadron will have the status of Cadets, with a corresponding opportunity to qualify as pilots and aeroplane observers. While no definite announcement has been made, it is believed that enlisted men in the balloon company will have similar status, qualifying them for practice with observation balloons used by the Coast Defense of San Francisco.

Applications for membership in the unit are being handled by Lieutenant Pugh, care of the Western Teachers' Exchange, Berkeley, and by Lieutenant Cavagnaro, 400 Lagunitas Avenue, Oakland, Calif.

Air Service Designations

Pending the revision of Army Regulations an order issued by the Secretary of War and signed by General Pershing, Chief of Staff, states that the designation "company," as used in regulations applying to troops of Cavalry and batteries of Field Artillery, applies also to squadrons, air parks, communications sections and photo sections of the Air Service. The designation "regiment," as used in the regulations, applies also to groups of the Air Service.

Martin Bomber Wrecked

Charleston, West Virginia.—The bodies of four of five of the crew of the Army Martin bombing plane No. 5, from Langley Field, Virginia, were found Sept. 5 on the north side of Twenty Mile Creek, ten miles southwest of Summerville, Nicholas county, and the fifth member is en route by automobile to Charleston in a dying condition, according to information received by Major Davenport Johnson, in charge of the army air forces stationed here. The dead are:

Lieut. Harry L. Speck, pilot, Medford, Ore.

Lieut. W. S. Fitzpatrick, observer, Medford, Ore.

Sergeant Arthur R. Brown, Kentucky.

Private Walter B. Howard, San Francisco.

The seriously injured man is Corporal Alexander C. Hazelton, Wilmington, Del.

The plane, No. 5, with two others, Nos. 22 and 24, left the flying field here for Langley Field. They ran into a storm and No. 5 in making a bank, evidently to return to Charleston, was seen by the other machines to go into a spin and fall. Nos. 22 and 24 reported the accident and search was immediately started. The observers in Nos. 22 and 24 could give only an approximate location near Poe, which made the search difficult, but which proved to be approximately correct.

The Late Captain Louis F. Appleby

In attempting a landing at Marrs Field, Chattanooga, Tenn., Captain Louis F. Appleby, Air Service, piloting a DH-4 aeroplane, overshot the field, striking a tree and knocking the roof from a house. As the result of the crash he sustained a fractured skull and other injuries which proved fatal.

Captain Appleby, who was born in Alabama 41 years ago, was a Spanish War veteran, serving as a private with the 5th U. S. Infantry in Cuba from May, 1898, to February, 1899. He served two years in the Philippine Islands during the Filipino Insurrection, being a sergeant in the 33rd U. S. V. Infantry. He then served for a period of seven months as a Lieutenant in the Philippine Constabulary, and for several years thereafter held a position in a civilian capacity with the military establishment and later with the Civil Government in the Islands. His principal occupation in civil life was the legal profession.

During the World War he joined the second Infantry Officers' Training Camp at Leon Springs, Texas, in September, 1917. Upon graduation he was commissioned a 1st Lieutenant in the Aviation Section, Signal Reserve Corps, and placed in command of a large detachment of flying cadets at Love Field, Dallas, Texas. In February, 1918, he was placed in command of the 277th Aero Squadron which he helped to organize. He received his promotion to the grade of Captain on May 3, 1918. In the following October he was transferred to Kelly Field, Texas, for flying training, and he received his rating as Reserve Military Aviator on January 10, 1919.

In February, 1919, he was transferred to Rockwell Field, San Diego, Calif., for pursuit training, and upon the completion of the course was again assigned to Kelly Field, Texas, and placed upon border patrol duty.

Captain Appleby was discharged as an emergency officer on March 7, 1920. He subsequently took the examination for appointment in the Regular Army, and on July 1, 1920, was commissioned a Captain in the Judge Advocate General's Department. His application for transfer to the Air Service, Regular Army, was approved, and he reported to Carlstrom Field, Arcadia, Florida, for a refresher course. He was stationed at that field until May 7, 1921, when he was transferred to Corps Headquarters at Fort McPherson, Ga., where he assumed the duties of Assistant Corps Area Air Officer under Major Clagett. He returned to Carlstrom Field on August 1st for his aeroplane pilot tests, which he passed on August 3rd.

Captain Appleby's services in the Army demonstrated that he possessed the ability of an executive of the highest caliber. He was tireless in his devotion to duty and a steady, reliable officer. His death is a great loss to the Army and a source of deep regret to his brother officers and many friends.

Airmen to Attend Dinner

Aviation experts to the armament conference in Washington will be guests at the third annual dinner and reunion of American aviators at the Hotel Commodore on Armistice night, November 11.

The committee includes Laurence L. Driggs, chairman; Arthur H. Alexander, Gerald C. Brant, Edward V. Rickenbacker, Sumner Sewell, E. Garnsey Brownell, Elliott Springs and James B. Taylor, Jr.

Book Review

There has just appeared from the press of George H. Doran Company a very interesting book entitled "The German Air Force in the Great War," compiled by Major George Paul Newman and 29 fellow officers in the German air service.

This book is based on the records of the twenty-nine officers and officials of the naval and military air service and is therefore one of the most valuable documents that has thus far come out of Germany. The illustrations, thirty-five in number, show every phase of aerial activity. Valuable new material is set forth in detail and many official secrets are released for the first time. The closing chapter gives the German viewpoint on the future of the aircraft. They are not immediate competitors with the railway and automobile, but their sphere does lie far beyond the present conception. They will be of aid in high-seas fisheries for instance, they will aid the police force, be used for making maps and will of course shorten space.

FOREIGN NEWS

Dutch Service Aircraft Markings

It is notified in Admiralty Orders that the markings of Dutch military and naval aircraft have been altered by Royal decree as follows:—At the end of each wing (on the top side of the upper plane and the under side of the lower plane, and in the case of monoplanes on both sides of the plane), also on both sides of the body of the machine, the mark carried shall be a circle divided into three equal sectors, and a small concentric circle within them. The inner circle is to be orange coloured and the sectors of the outer circle are to be coloured successively red, white and blue. These marks will be carried only by Dutch military aircraft; the word "military" is here used in the sense of "non-civilian."

New Air Mail Service from Cairo to Baghdad

The new air route which was recently opened across the desert from Palestine to Mesopotamia is, it is officially notified, to play its part in the establishment of an air mail service which has been authorized between Cairo and Baghdad. This service will be operated by Royal Air Force aeroplanes, and is being undertaken as part of the training programme in the Middle East; it is to run fortnightly from August 1. For the present the service will be restricted to the conveyance of official correspondence, and all Government Departments concerned have been invited to use it. Outgoing mails will be collected at two centres—London and Cairo. Those from London will be forwarded by the G. P. O. by ordinary transport to Egypt, the bags being handed over at Port Said by the captain of the steamer to a representative of the Royal Air Force. These, together with official dispatches gathered together at Cairo, will be forwarded by air from the aerodrome at Heliopolis. The route which will be followed is:—Heliopolis-Ramleh, 260 miles; Ramleh-Amman, 65 miles; Amman-Kasar Azrak, 55 miles; Kasar Azrak-Ramadie, 400 miles; Ramadie-Baghdad, 60 miles. The total length of this line is 840 miles. On arrival at Baghdad the bags will be handed over to the postal authorities for distribution. Correspondence from Mesopotamia to England and to Egypt will be handled in a similar manner. It is estimated that a saving of 10 to 14 days will normally be effected by this service, but in the meantime only duplicates of correspondence will be forwarded.

German Civil Aviation

The extent to which the German Government is fostering civil aviation is not generally recognized, and the information given by the Secretary for Air of the British Government on this subject in Parliament will open the eyes of many people. Remarkable progress is being made, having regard to the restriction on aircraft construction imposed by the Peace Treaty. There are in Germany two main bodies which virtually control all air traffic—the Deutsche Luftreederei and the Nord Deutsche Lloyd. The latter comprises some eight or ten companies, the most important of which are the Rumpler, Albatross, Sablatnig, and Junker concerns. Large numbers of societies have been founded throughout the country with the object of stimulating interest in, and promoting the development of aviation in all its civil aspects. The government is indirectly represented on the "Flug and Haven," which is the most influential of these institutions. Although prohibited by the Allied authorities from running air services outside of Germany, a number of internal air routes are in operation, and a considerable sum has been allotted by way of Government subsidy. All the services, the majority of which are based on Berlin, are being maintained by about 100 old military machines which the operating companies have been allowed to acquire.

British Transport Records

Two air transport companies have created new records for themselves last week. The Instone Line carried no fewer than 188 passengers over the London-Paris route, and the Messageries Aeriennes carried 103 air travelers over the same route. Both of these figures are records for the firms concerned. In spite of this, however, the total of all traffic for the week was below that for the past few weeks, being only 482. This is due to a falling-off in passengers on the Amsterdam route, and to an epidemic of engine trouble on the "Goliaths."

Aerial Survey in India

Following on the announcement that a survey of the Orinoco delta is being undertaken by the Bermuda and West Atlantic Aviation .Co., we see that the Survey Department of the Government of India has issued a paper which deals with some experiments in aerial surveying which have been made out there, and draws conclusions therefrom. To test the utility of the aerial camera a mosaic of the city of Agra was made, but the survey experts concluded that "nothing is to be gained by adopting the air method for normal one-inch surveys of the plains of India." This conclusion can be easily appreciated. The report goes on, however, to consider the problem of surveying large areas of densely wooded hill country, of which there are many in India and Burma, and for these the use of the aerial camera is recommended. It is sometimes important that these tracts should be accurately surveyed for mining or forestry purposes, but the expense of surveying from the ground is very high, and indeed, when minor details are needed, it is often prohibitive. The aerial survey, in fact, seems to be the only practical method.

The Survey of India report naturally dealt with broad principles and mainly from the point of view of the surveyor who wants a map. The aeronautical side of the question is also of great interest, comments AERIAL AGE. An officer of the Royal Air Force was employed for the experiment, and there is a danger that such a very official Government as that of India should never go further than consulting the Service men. Able as these officers are in their work, one cannot expect them to look at commercial and industrial matters from the same impartial point of view as men who have devoted themselves to the study of civil flying. In this case it is to be hoped that the Government of India does not intend to risk the lives of pilots unnecessarily by sending them in ordinary Service aeroplanes to fly over "large areas of densely wooded hill country." Such work should be reserved for special multi-engined aeroplanes which can be guaranteed immune from forced landings. Or, again, the semi-rigid airship, about the suitability of which for India we recently published an article, may prove a success out there; and if so its power to fly slowly not far above the level of the earth should make it particularly suitable for survey work. In wooded country which is not hilly, but where smooth water abounds, such as the Sandarbans (i.e., the delta of the Ganges and the Brahmaputra) and some parts of Burma, the seaplane or flying boat may prove the best craft. The Orinoco expedition will soon provide data for deciding that point.

Work of the British Air Office

Major C. C. Turner gives the following interesting data on the work of the British Air Office in the London *Observer.*

Civil flying having been the care of a separate State department only since May, 1919, a great deal of foundation work has been necessary; and the amount of official supervision has been greater in the first two years than it will have to be in any future period of the same length. The International Air Convention is not yet ratified, but so far as Great Britain is concerned most of its provisions are already being carried into effect. The amount of flying may not be considerable, but it has been necessary to lay down the same rules for it as if it were ten times as much.

The Air Ministry issues notices relating to navigation, to prohibited areas, to Customs, to wireless, to details concerning the care of machines, and so on. It follows that all who have to do with our air routes are weekly, and sometimes daily, in receipt of communications from the Air Ministry. By many of those concerned these notices have been preserved and classified for reference, and they constitute a valuable and interesting record.

The Air Ministry issues notices to airmen on green paper. In this case, by the way, "airman" means "pilot," whereas in the Royal Air Force an "airman" is one of the rank and file, who very rarely go up into the air in any capacity. Notices to airmen, which are frequently added to, or "cancelled," as the case may be, give lists of wireless stations in operation in connection with civil air routes, together with the call sign and wave lengths used by each, and the latitude and longitude; and there are similar lists for France, Belgium, Denmark, and other countries; they warn pilots of temporary obstructions; a recent one sets out the plan for the compulsory examination of pilots in meteorology; they give rules governing imports by air into France, Holland, and other countries; new signposts and lighthouses are the subject of frequent notifications; the flying of kite balloons at Howden airship station is the subject of a warning to aviators; "summer time" regulations in the various European countries are notified; the movement of a lightship in Danish waters is published; and the enlargement of the "aerial corridor" into France is notified.

The periodical issue of the "Consolidated List of Aerodromes for Civil Use" tabulates all Government-owned aerodromes containing accommodation, all emergency aerodromes, all licensed civil aerodromes, and all unlicensed private aerodromes. These show the nearest railway station, the height above sea-level, and other particulars. One notice gives the cloud, visibility, and weather signals displayed at Lymphe for the information of passing airmen; a simple code enables him to see ahead the conditions he will have to fly through.

Yellow papers are those containing notices to ground engineers, and they concern such details as the tightening of bracing wires, the disuse of high-compression pistons on a particular type of engine, a warning as to the discovery of a weakness in the valve rocker of a certain type of engine, a warning that certain control cables should be replaced by a stronger kind, a caution that the rubber connections in petrol systems must be frequently examined, and many other technical details only understood by the expert.

In addition, the Air Ministry issue periodically a "Resumé of Commercial Information," consisting of extracts from the foreign Press, together with much information obtained by the Ministry from other sources that is likely to be serviceable to British firms. It also issues the lists of new pilots' licenses, statistics of flying and the passengers and goods conveyed by air, the customary half-yearly reports (with the Air Ministry's own summary for newspaper purposes), and, of late, much Press matter relating to airships and the report of a lecture by the Controller-General of Civil Aviation to the Institution of Civil Engineers.

A valuable series of technical memoranda containing the results of the latest researches are published, and are on sale in the usual way. And occasionally there is a little blue-covered book, for example, one dealing with the compulsory examination in aerial navigation of all pilots, which, however, one gathers is not yet strictly compulsory.

Stockholm-Reval Service

On the 19th of August, the air service between Stockholm and Reval was begun, with Italian seaplanes, Savonia type S16. Pilot Longo, with mechanic Pescatori made their first trip in three hours time carrying on board three passengers and the mail load. The line, which is run by the Svenska Lufttrafik company, will soon be extended as far as Helsingfors.

A Maharaja Helps Forward Aviation

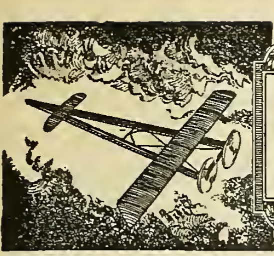
At Allababad the Maharaja of Bharatpur has, according to the *Daily Telegraph* correspondent, opened an aviation academy with a fully qualified aeronautical staff. The academy proposes to deal with every branch of aviation, including flying instruction, instruction of ground staff, the sale and erection of aeroplanes, and passenger flying. His Highness has fitted out a large aerodrome occupying over 1,500 square yards, which has a good surface throughout. Would-be owner-pilots will have the use also of the splendidly equipped Bharatpur workshops.

New Hanriot Coming Along

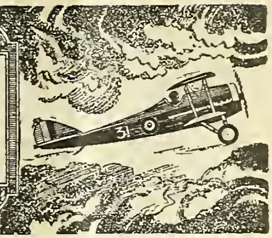
The French Hanriot works are completing a new machine in which metal construction has been extensively used. The machine is said to be intended for colonial use, and can be used to carry six passengers. If used for military operations the machine will carry the equivalent weight in bombs. As an air ambulance the machine can be adapted to carry, in addition to the pilot, two stretcher cases and an attendant.

The Coupe Michelin

French pilots have been working hard in connection with the Michelin Cup during the last week or so. The contest is for a circuit of France (3,000 kiloms.—1,860 miles), and was last won (in 1914) by Eugene Gilbert on a Morane-Saulnier monoplane. This year Bossoutrot competed on a Farman Bajac on a Spad and Poiree (of Monaco fame) on a Caudron. Bossoutrot had to give up, and the race rested between Bajac and Poiree. Just as we are going to press it is learned that the competition was won by Poiree on the Caudron, whose time for the trip was 37¼ hours.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



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Historical Review of the Capitol Model Aero Club

The Capitol Model Aero Club, Washington, D. C., organized in 1915, has prospered every year since, although at some times more actively than others. The total number of models made by members approximates sixty, and the members enrolled since incorporation number over fifty. Model meets at various times have demonstrated the efficiency of the members' efforts, and by window displays, etc., local interest has been kept aroused in aviation. Aside from the actual model making, the endeavor has always been to teach and maintain an interest in senior areonautics; this has resulted in furnishing three pilots to the American Air Forces, and one to the Air Mail Service, beside several "Ground Aces", as they call mechanics and such.

At present most of the members are away on vacations and business, but with the early fall, the Club is to open for the season, and an unusually large membership is expected, together with more than usual enthusiasm. The plan of procedure will be similar to that of former years, namely, of promoting a member thru successive grades as he shows aptitude and knowledge, and thus encouraging study and manual effort. The different steps are rewarded by suitable insignia for which the members diligently strive. The meetings are accompanied by lecture upon an interesting phase of the work, beside the regular business, and various contests are held to determine the most active members.

In Mr. Garber's work with the boys, he is most ably assisted by his two major officers, Mr. Burt, and Mr. Irelan, both excellent artisans in model aeroplanes, and ardent enthusiasts of aerial transportation, of whom future aeronautics may well expect a great deal, if they keep up their present efficiency.

To the devotee of model making, the Club extends its hand in comradeship, and assures any one taking up the science, an occupation which will deliver more true fun and genuine knowledge than any other, and gives its own experience as proof.

The Club will keep Aerial Age readers informed of its movements and asks for correspondence from other clubs.

Their address has changed from 1726 M street, N. W., to 1210 18th street, N. W., and all communications should be addressed to the president of the Club, Mr. Paul Edw. Garber, who is the Aeronautical Modelmaker of the U. S. National Museum, Smithsonian Institution, Division of Mechanical Technology.

Notes of the Illinois Model Aero Club

The first hand-launched duration meet of the Illinois Model Aero Club brought out several record breaking models. The model made by Mr. Pond flew 2,465 feet, breaking the world's record. This model weighed only one and one-half ounces. Another machine, built by Mr. Warren De Lancey, a forty-eight inch hollow spar twin pusher, made over 3,000 feet, a dozen times or more.

The former official world's record twin pusher hydro duration of 118 seconds (held by Bruno Likosiak) has been officially broken by Mr. Bertram Pond, who made 172 seconds by the I. M. A. C. first meet of the year at Lake Calumet, Chicago, Ill. The three official flights in the contest averaged nineteen seconds more than the old record, proving that the latest record was not made by a freak flight or by a lucky chance.

Below is a schedule of I. M. A. C. events from August to December, 1921:

1. Aug. 19. Business meeting. Talks on general design.
2. Aug. 21. Hand launched duration meet at Ashburn Flying Field.
3. Sept. 2. Business meeting. Construction of models demonstrated.
4. Sept. 5. Annual speed and looping contest. 300 foot course for speed.
5. Sept. 16. Business meeting and model talks.
6. Sept. 25. Hand launched distance meet, and picnic at Ashburn Flying Field.
7. Oct. 7. Business meeting and model demonstrations.
8. Oct. 21. Business meeting and talks by pilots.
9. Nov. 4. Business meeting.
10. Tuesday, Nov. 15. Tenth annual Illinois Model Aero Club banquet.
11. Nov. 18. Business meeting. R. Jaros authority on scale models will speak.
12. Dec. 2. Business meeting and annual scale model contest.

All business meetings are held in Room 132, Auditorium Hotel at 8. p. m.

To reach Ashburn Flying Field, take Wabash suburban train to Ashburn station and walk 4 blocks west.

Model Builders Employ Standard Wing Sections

An ever increasing tendency is shown by model builders toward the adoption of tested wing sections in general use for carefully built scale and flying models. In the earlier days of model building, flat wings and thin wing sections constructed with a view to ease of construction, resulted in very slow progress in distance and duration flights.

Referring to records made several years ago, we find few records of record flights made, except by builders who became skillful as designers of light, efficient wing curves. At the present time it is observable that more builders than ever avail themselves of the information given out by the government on the subject of the lifting properties of various wings tested. Model builders realize the great advantages that are possessed by those who have an extensive knowledge of wing-curve characteristics. By testing out some of these curves on the ordinary "A" type rubber driven models, it is possible to become thoroughly acquainted with the contours of approved standard wing curves, and even some of their aerodynamical properties can be witnessed during flight. Model builders will appreciate, however, the differences that exist between the behavior of a wing-curve during flight, the angle of incidence of which can be altered (as in a full-sized aeroplane), and the performance of a curve held rigidly to one incidence angle, as necessary in a model. Sufficient information to make the subject interesting is to be had by putting to some immediate practical use this valuable information which is not so easily understood or remembered by a casual reference to it.

Members of the Illinois Model Aero Club. On the ground at the right can be seen Mr. Pond's tractor which flew 2465 feet. Above it is Mr. Schweitzer's 4029 foot record holder. Two of the other models shown have flown over 175 seconds duration

"My First Solo"

I climbed up in the machine,
To make ready for a flight.
OH, what a feeling.
Up and up I rose with the J. N.
For the O. X. was humming merrily.

I looked down to see the world rush by,
On and on I sped.
OH, what I feeling I had.
I nosed her over to make for a landing,
No landing place could I see.

Near and nearer I glided to earth,
With the machine out of control.
OH, what a feeling I had
Heading straight for a tree,
For when I awoke, I found myself under an OAK.

Standing near was a little boy,
He said to me,
"Honest, mister, I only shot at a sparrow."
OH, WHAT A FEELING I HAD. —*"Rupe."*

Our Memory's Good, the Joke's Old

Patient: "I wish to consult you with regard to my utter loss of memory."

Doctor: "Ah, yes! Why—er—in cases of this nature, I always receive my fee in advance."—*Science and Invention.*

Yeah

Prof.: "Would you call the last decade of trouble in Mexico a civil war?"

Stude: "Wadda you mean 'civil'?"—*Missouri Showme.*

Sweet Hopefulness

"That's a bad cold you've got, old man. Are you doing anything for it?"

"Not yet. I'm in hopes that it will get bad enough to be good for a prescription."—*Judge.*

Wouldn't Last Long

A tourist in Scotland came upon a farm in a remote highland glen.

"How delightful to live in this solitary spot," he remarked to the farmer.

"I'm no sae shair about that, sir," replied the farmer. "Hoo wad ye like to hae to gang fifteen miles for a glass of whusky?"

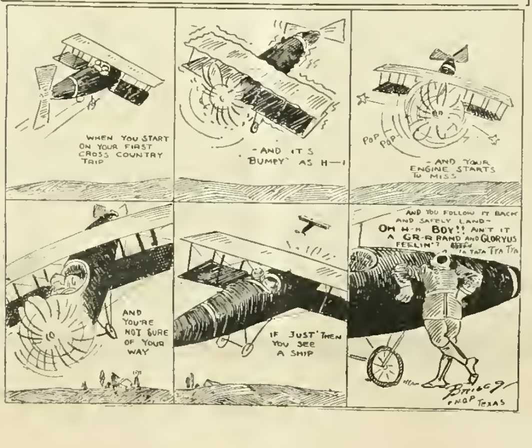
"Oh," said the tourist, "but you could keep a bottle."

The farmer shook his head.

"Ah, mon," he said seriously, "whusky'll no keep."

—*Pittsburgh Chronicle-Telegraph.*

Ain't It a Grand and Glorious Feelin'? . . By BRIGGS


WHEN YOU START ON YOUR FIRST CROSS COUNTRY TRIP
-AND IT'S 'BUMPY' AS H—I
POP POP
-AND YOUR ENGINE STARTS TO MISS
AND YOU'RE NOT SURE OF YOUR WAY
IF JUST THEN YOU SEE A SHIP
AND YOU FOLLOW IT BACK AND SAFELY LAND-
OH H-H BOY!! AIN'T IT A GR-R RAND AND GLORYUS FEELIN'?
TA TATA TRA TRA
BRIGGS
TEXAS

Embarrassed

I longed to tell her, and yet my tongue clove to the roof of my mouth; would she understand, I wondered? I had known her but a scant month, and yet I felt as though I had known her for months, aye, for years, and yet . . . How can one tell a woman that she has forgotten to rouge both sides of her face?—*California Pelican.*

Had to Be Shown

"Noo, tell me," said the Scoth customer, "is this hair restorer certain tae mak hair on a bald heid?"

"Yes, sir," said the druggist. "It will accomplish it in twenty-four hours."

"Weel," remarked the other, "that's nae lang tae wait. Just rub a lettle on yer ain bald place and I'll come in in the morning an' see if yer spekin' the truth."

—*Pittsburgh Chronicle-Telegraph.*

It was down at Langley Field
That their rep was firmly made;
When the battleships had to yield
To the boys of the 1st Brigade.

Days and weeks and months they worked
With bombs and sights and racks;
No mission, trip or job was shirked,
They were right there with their hacks.

U-boats, cruisers and dreadnoughts too,
The best that rode the waves,
Were sent to rest by an aerial crew,
And they rest in watery graves.

Far out o'er the sea or way up high,
Far away from old mother earth,
Carrying bombs thru' the stormy sky,
The brigade has proven its worth.

In future days new wars will be fought,
And new history will always be made,
But never will a better lesson be taught,
Than the one taught by the 1st Air Brigade.
—*Hargemac.*

A young man came out to the field,
To inspect the aeroplanes, with me at his heels.
After the inspection he made up his mind,
To take a spin in a canuck, and he will find,
The fuselage out of line. —*"Rupe."*

"Aeroplane Talk"

A roar, a buzz, an aeroplane appeared in the western sky,
It came down to make a landing from way up high,
The pilot climbed out, his name I believe was Sims,
From New York to Chicago to deliver moving picture films.

Filled with oil and gas he took off,
To go up aloft,
A roar, a buzz growing fainter and fainter, till it was a dot,
For the afternoon was sultry and hot.
—*"Rupe."*

Some Live Wire

Officer: "Why didn't you send that electrician to fix my door bell?"

Sparks: "He did go, sir, and as he rang the bell three times and got no answer, he concluded that there was nobody home."

—*Great Lakes Bulletin.*

Cluck, Cluck!

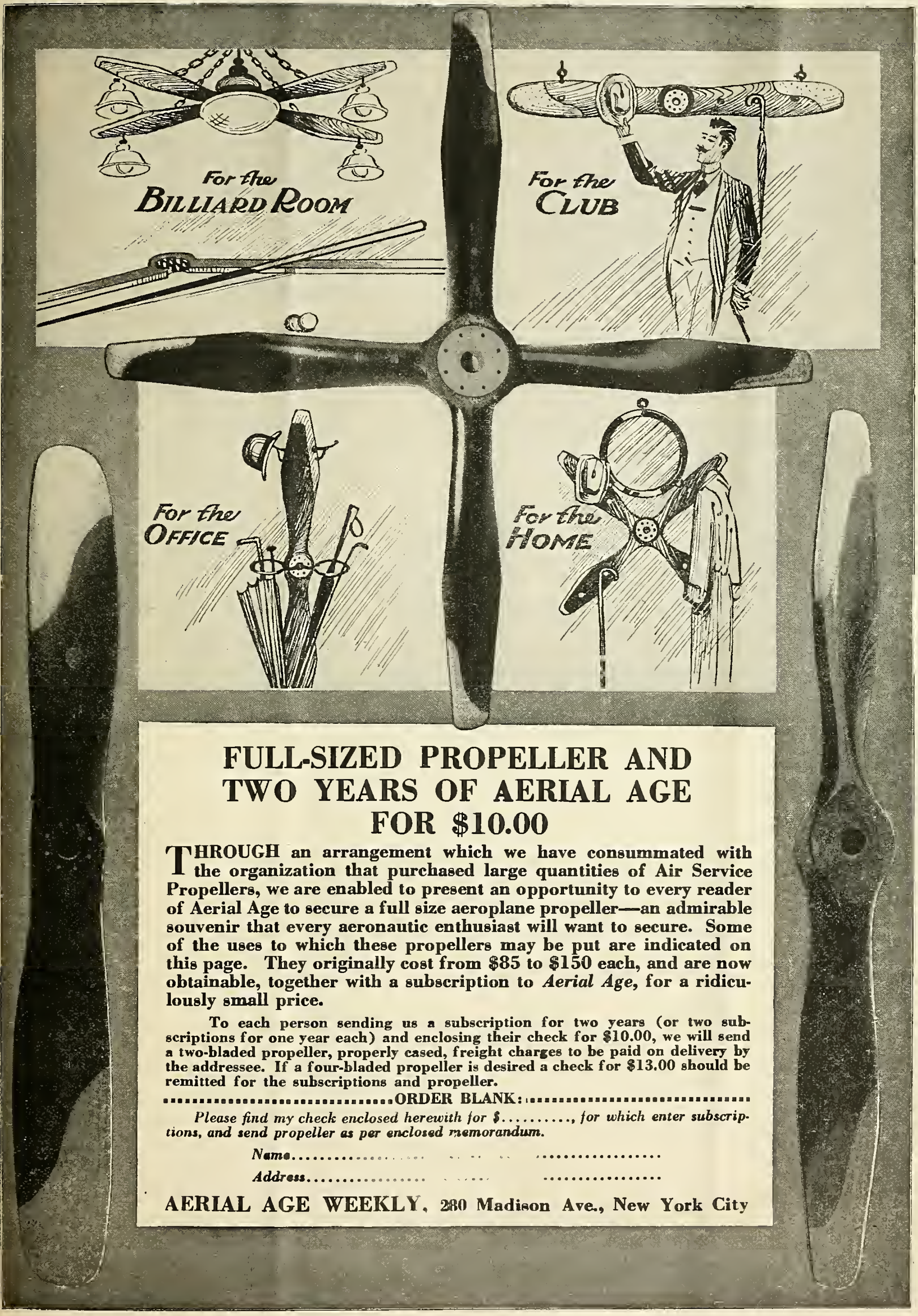
Poet: "Did you receive my poem, 'The Patient Hen?' "

Editor: "Yes, it's laying in the waste basket."—*Judge.*

Like the Dodo

"Yes," remarked the highbrow caller, "I rather pride myself on the discovery of another hypothesis."

"Indeed!" returned Mrs. Newrich, a little doubtfully. "I had an idea they were quite extinct."—*Boston Transcript.*



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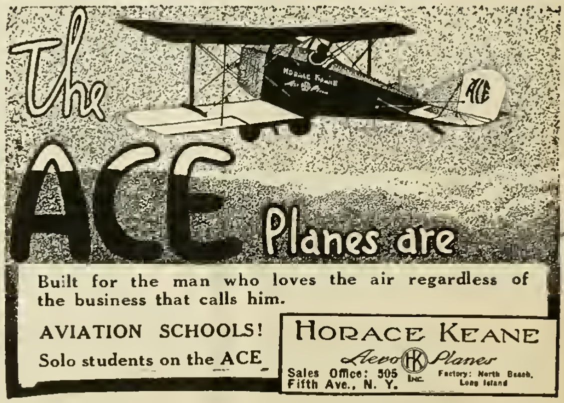

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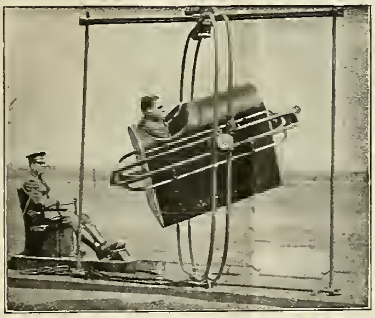

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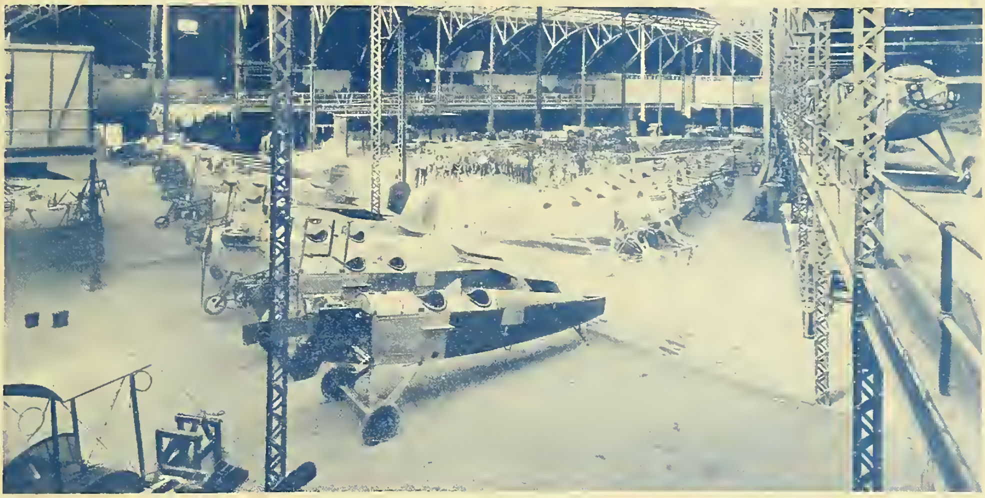

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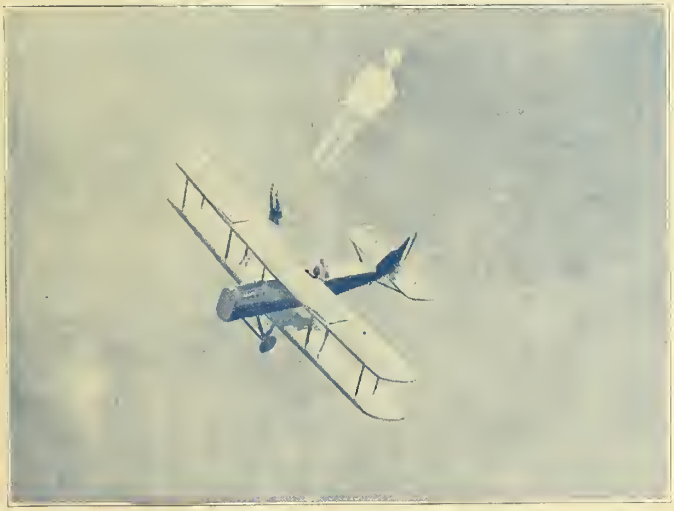

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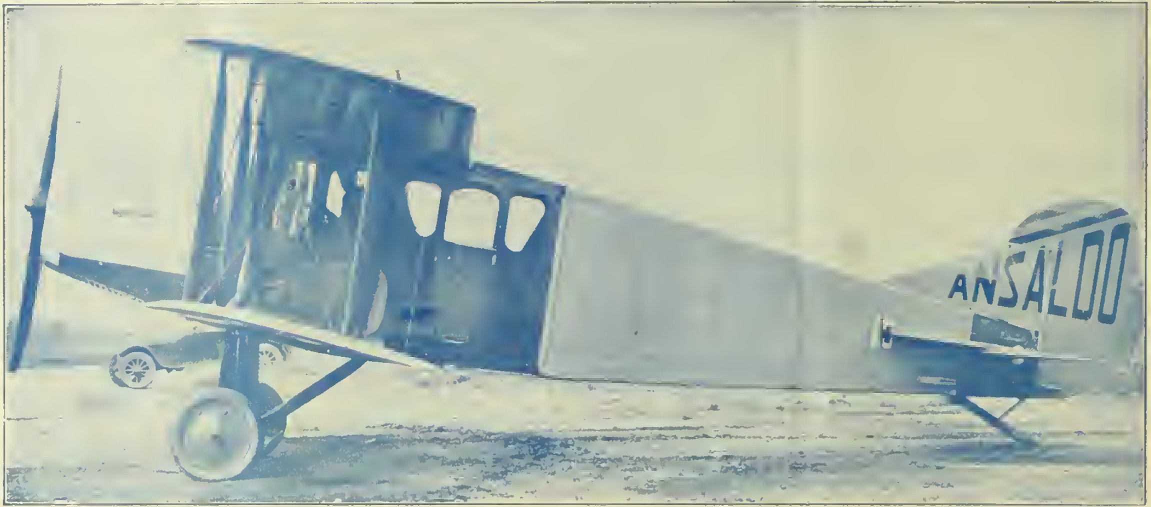

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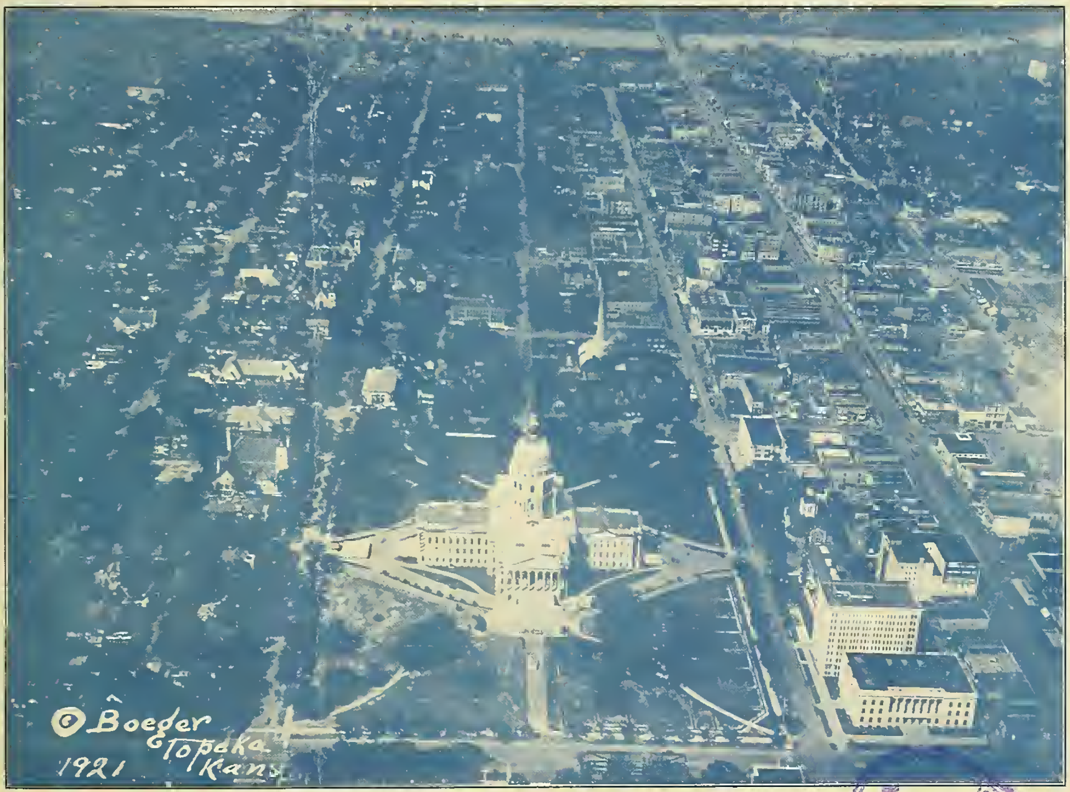

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Does Engineering in Aeroplane Design Pay?

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AERIAL AGE
WEEKLY

VOL. XIV, No. 3

TABLE OF CONTENTS

Does Engineering in Aeroplane Design Pay? 51
The Aeroplane Speaks 51
The Versatile Aeroplane 51
A Bureau of Commercial Aeronautics 52
The News of the Week 52
The Aircraft Trade Review 54
The New Longren Biplane 55
A Money Saving Ford Accessory 56
Electro-Magnetic Brakes for Aeroplanes 57
A New Method of Testing Models in Wind Tunnels 58
United States Post Office Department Air Mail Service 62
Naval and Military Aeronautics 63
Foreign News 64
Elementary Aeronautics and Model Notes 65
Aeronitis 66

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Does Engineering in Aeroplane Design Pay?

IN last week's editorial column the need was discussed for more and better engineering in order to secure greater safety in aeroplane operation. It was shown that from this viewpoint to economize on engineering was a most expensive and hazardous business.

But there is another side to this question. Assume that an aeroplane is strong enough, is protected from the danger of fire, and is stable. Suppose no accident ever occurs to it. Does it follow that such an aeroplane would be commercially successful where such success is possible with proper equipment? Not at all. Three other requirements must be met by the real commercial aeroplane. These are high ratio of paying load to gross weight, good performance as regards speed and rate of climb, and ease of maintenance. The extent to which these requirements are met is directly proportional to the quality of the engineering invested in the design and is the measure of the success of the aeroplane commercially.

Not until aviation was put upon a highly competitive commercial basis did the difference between a mediocre design and the creation of a master become so glaringly apparent. It is necessary to realize that each unnecessary pound of weight in the structure and power plant is a pound lost from the paying load. When one considers that the portion of the disposable load, aside from the pilot, fuel and oil, is only 25 to 30 per cent of the gross weight of an aeroplane, the saving of 10 per cent in the weight empty increases the earning power of the aeroplane 20 to 25 per cent.

Good engineering by improving the cleanness or "fineness" of a design makes possible either an increase in paying load at least equal to 20 to 30 per cent, based on an average good design, or a large decrease in the size of the power plant with a corresponding reduction in operating expense, to say nothing of first cost. The JL-6 was one of the first notable examples of the tremendous increase in efficiency through proper design. A later and even more striking example of what can be accomplished in this direction is Fokker's latest passenger aeroplane carrying 1000 pounds of paying load in addition to the pilot and five hours' fuel. Compare this with the performance of the DH-4 mail planes which, with a 400 horsepower engine, have a maximum mail load of 700 to 800 lbs., and only 2.5 to 3 hours' fuel. In the one case we have over four pounds per horsepower and in the other less than two. What is the inference to be drawn? Does 100 to 150 per cent increase in efficiency justify the expense of securing the services of the finest talent to be had?

Few people who are not actively connected with aeroplane maintenance problems realize the differences in maintenance costs between aeroplanes. From the viewpoint of a commercial company a design in which ease of maintenance has not been considered is a double expense. There is first the direct cost of rigging, repairing and general upkeep, and second, the loss of revenue for each day the aeroplane is laid up for repairs. One type of aeroplane may be in the overhaul department 50 per cent of the time, another 10 per cent. In these days of narrow margins of profit what chance has the first aeroplane to be anything but a white elephant? What makes the difference between the two designs? Nothing but the knowledge, thought and experience of a trained engineer.

And still one sometimes hears it said that a commercial firm cannot afford to secure the services of such a man.

B. C. B.

The Aeroplane Speaks

THE aeroplane spoke a fateful word or two at Hampton Roads last June and July, and if indications are realized it will shout out loudly when the old Alabama is bombed by air service machines this Fall.

General Mitchell is to be congratulated on the courageous report which he has placed in the hands of his chief, General Menoher, and it is to be hoped that army usage and etiquette will not stand in the way of the report getting the impartial consideration which it merits. The Assistant Chief of the air service got his knowledge of what can be done with aeroplanes at the working end of the "joy-stick," and that stacks up pretty strongly against purely theoretical deductions.

The Versatile Aeroplane

UNDER the above heading the *Dayton Journal* of August 6th makes the following editorial comment on the many varied uses in which the aeroplane is employed at the present time.

The aeroplane had first to prove its possibility. Then it had to prove its practicability. Now it is demonstrating its versatility. With this established the aeroplane, just as its predecessor, the automobile, can settle down to the quiet task of meeting man's needs.

We have small, fleet aeroplanes today that travel faster than any other contrivance man has fashioned. We have larger, more cumbersome planes that carry great loads successfully for long distances. We have planes that operate over land or sea at will and with ease; planes, too, that can and in the sea even when the water is rough. We have planes that ascend to terrific heights in search of scientific data, and planes that engage in something as prosaic as the spreading of arsenate of lead over catalpa trees suffering ravages of insects.

Think of the versatility of the planes today—man's new toy is but partly understood and barely developed! Aeroplanes serve to deliver important mail to ships far at sea, the planes reaching the ship in a few hours from the same port the ships sailed many hours before. Aeroplanes are used to cut tedious hours from the delivery time of trans-continental mail. Aeroplanes are used by a rancher to speed him in a few hours over all his vast acres, giving him information it formerly took many cowboys days to gather for him.

Recently, when engineers were undecided as to which of three routes would be best for the construction of a railroad through certain mountains, aeroplanes took the engineers over the three routes in a few hours and showed them beyond question which was the most practical, whereas old-fashioned surveys would have taken months and cost thousands of dollars. Aeroplanes have been used in rushing persons critically ill to specialists or special hospitals many miles away. Aeroplanes are the surest, strongest weapon of national defense, as witness the recent bombing tests over the Virginia Capes, and the theoretical bombing of Washington, New York and Philadelphia.

New uses to which aeroplanes may be put are being found each day. Who dreamed, in 1899 or even in 1904, of the uses to which the automobile would be put? Who dreamed in 1909 or even in 1914, at the outbreak of the world war of the uses to which the aeroplane would be put in 1921? Who can place any limitations on the possibilities of the aeroplane 10 years from now? The aeroplane is in its first stages of development and its versatility is only now beginning to be appreciated. Ten years from now what may we not see!

A Bureau of Commercial Aeronautics

CONGRESS seems prepared to act at last upon the matter of air traffic. Senator Wadsworth recently introduced a bill "to create a bureau of civil aeronautics in the Department of Commerce, to encourage and regulate the operation of civil aircraft in interstate and foreign commerce, and for other purposes."

There is something in these words suggestive of colonial charters to far islands and unexplored continents. Perhaps the suggestion is just. The air is a great empire in the process of charting, and Mr. Hoover, like President Jefferson at the time of the Louisiana purchase, is taking over something bigger than he can imagine. It is time, of course, that he or some government official was directed to institute the supervision of civil flying. Twelve hundred aeroplanes operated commercially last year, says the Manufacturers' Aircraft Association, flying over 3,250,000 miles. Unfortunately they made a return of forty serious accidents, resulting in fourteen deaths. Most of the accidents seem traceable to a lack of regulation—to unfit 'planes, poor landing fields, foolish "stunts," lack of meteorological information, etc. Senator Wadsworth's bill meets this situation. It provides for a bureau and commission of civil aeronautics. The bureau will examine and license pilots, inspect aircraft, make air traffic rules, assist in developing landing fields, stations, weather flying reports, etc. It will fix fees and keep records. The commissioner or his deputies can subpoena witnesses, send for documents and papers, administer oaths, take testimony, etc., in all cases affecting the granting or revocation of licenses. The commissioner is ordered by the bill to make an annual report upon his work, to be included in that of the Secretary of Commerce. Provision is made that "the district courts of the United States shall have exclusive jurisdiction over all claims and controversies involving aircraft, airdromes, and air stations, their owners, lessees, charterers, and operators licensed thereunder." The procedure "shall conform as nearly as may to the principles of law and procedure applied in cases of admiralty jurisdiction."

If Congress passes this bill it will have taken the first step toward a thriving American air industry. Flying has obviously needed regulation. The proposed bureau of civil aeronautics provides it. Under such a body useless waste of life will be avoided. Competent inspectors will weed out unsafe 'planes and forbid the air to incapable pilots. Air traffic will be controlled. With the consequent reduction of risk public confidence in flying will grow. At the same time the government—if the words of the bill get a financial backing—can undertake certain positive and encouraging work calculated to stimulate the right kind of aerial activity.

Probably Senator Wadsworth's bill will pass. We have had a number of lessons as to air accidents. Our bombing experiments produced a new respect for aircraft in Congress and, it is understood, in the cabinet. The government perceives at last, apparently, that the activity which American genius made practicable is assuming too important a place to permit it being ignored or neglected longer.—*Editorial in N. Y. Globe.*

THE NEWS OF THE WEEK

General Menoher Resigns Air Service Post

Major-General Charles T. Menoher resigned September 16 as chief of the United States Army Air Service, bringing to a climax a long-standing row in which he and his assistant, Brig.-Gen. William Mitchell, have been the central figures.

Gen. Menoher's resignation took the form of a request to be transferred to command troops in the field. There is every reason to believe the request will be granted by the Secretary of War, who then will be called upon to appoint a successor.

This will open one of the most bitter questions in the military establishment, whether there is to be an independent air service. This issue was the underlying cause of the differences between Gen. Menoher and Gen. Mitchell, but the trouble between the two, which at one time prompted the chief to ask that his assistant be relieved, will fade into insignificance when compared with the fight that is brewing.

Gen. Mitchell of course will be a candidate for chief of the service, with the support of virtually all the officers in the flying establishment, together with much outside influence, such as that in Congress. Against this will be arrayed the strength of those army officers, mostly those of high rank, backed by a strong navy sentiment, who want the air service to remain as an auxiliary arm in the fighting organization.

Just how soon this fight is likely to come to a close Secretary Weeks did not reveal. He said Gen. Menoher's request for transfer is receiving consideration. Gen. Menoher himself has not been advised what to expect, but he is confident his wishes will be fulfilled. It is possible the whole matter will rest until the return to the United States of Gen. Pershing, Chief of Staff of the Army, who is on his way to France and is not expected home much before November 1.

It may be said authoritatively that Gen. Menoher's decision to retire as chief of the air service did not come as a result of any specific incident in the long-continued clash with Gen. Mitchell, but rather in consequence of the whole. Specific denial has been made that Gen. Mitchell's recent reports on the bombing tests held in June and July off the Virginia Capes had anything to do with the action. These reports have not been made public, but it is understood sharp issue is taken by Gen. Mitchell with the conclusions of the joint board headed by Gen. Pershing and composed of officers of the army and navy, whose report, while crediting aircraft as a powerful factor in modern warfare, held that the battleship cannot be regarded as obsolete and an easy prey to aerial bombs.

Gen. Mitchell's contention has been that any warship afloat could be sunk with bombs. His declarations have antagonized the navy for months, officers of this service having been outspoken in their statements that Gen. Mitchell was trying to bolster up the air service by unfairly discrediting battleships.

The thing Gen. Mitchell really has been striving for, of course, has been the establishment of the air service as an independent branch of the military organization on a par with the army and the navy. He would consolidate under one Cabinet officer the flying services of the army, the navy and the Marine Corps, building up a tremendous air fleet for use over both land and water.

Gen. Menoher has been opposed to this, having the support also of most of the officers of the General Staff, including Gen. Pershing. He wants the army air service continued as an auxiliary for scouting purposes and attack, an army unit such as the cavalry, the infantry and artillery. Just as these dominant army officers want the air service kept in the army, the navy establishment wants to keep its own flying corps.

Much will depend on the recommendations to Congress that will be made soon by the joint Congressional Committee on Reorganization of Government Departments. The programme now being worked out by that committee provides for the consolidation of the War and Navy Departments under the title of the Department of National Defence, in which the air services are to receive special recognition, perhaps be consolidated.

Funeral Services for ZR-2 Victims

Funeral services were held September 17 at the New York Navy Yard, Brooklyn, for the fifteen Americans who lost their lives in the explosion of the dirigible ZR-2.

The services were attended by the diplomatic representatives of Great Britain, France and Brazil, Secretary of the Navy Denby with several American naval officers of high rank and several hundred relatives and friends of the dead with their invited guests. The ceremony itself was confined to the reading of the burial service of the Episcopal and Roman Catholic churches, the singing of two hymns and the placing of wreaths on the coffins.

Although preparations had been made for the handling of a crowd of 25,000, fewer than 500 attended, many persons being kept away by the rain, which fell throughout the services. The small number who attended, together with the incessant drizzle, prevented the funeral from being so impressive as it otherwise would have been.

When the bodies arrived on the British light cruiser Dauntless they were carried ashore and placed in building 16 at the navy yard. It was originally planned to hold an oper air funeral service on the athletic field, but the rain caused a change in plans.

The ceremony began at 2:30 o'clock. The coffins, draped with flags and flowers, were faced by chairs for naval officers and invited guests. The first four rows were reserved for friends and relatives of the dead. Behind the coffins, against a wall draped with American flags, were chairs for the chaplains and a few guests. Double columns of American, British, French and Brazilian marines faced each other along the two side walls.

Lieutenant Commander F. E. Moyer, Episcopal chaplain, read the Episcopal funeral service and ended with a short eulogy in which he said that the men had lost their lives because of "the love that is the bugle call that leads us to a higher civilization."

Then the New York police quartet sang "Lead, Kindly Light," and Secretary Denby stepped forward, and in behalf of President Harding and the Navy Department placed a wreath on each of the fifteen caskets. He was followed by representatives of the British Embassy.

Chaplain Matthew C. Gleason, Catholic chaplain, then read the Roman Catholic burial service, and the police quartet sang "Nearer My God, to Thee." Three volleys were fired by marines outside, the bugler sounded taps and the mourners filed out of the hall.

Oswald C. Hering, in behalf of the D. K. E. Fraternity, as its president, laid on the casket containing the body of Commander Louis H. Maxfield a large wreath in the fraternity colors of red, gold and blue. Commander Maxfield joined the fraternity while a student at the Massachusetts Institute of Technology.

With Secretary Denby were Capt. D. F. Sellers of the navy and Col. D. D. Porter of the Marine Corps. Others who attended were Rear Admiral W. A. Moffatt, Rear Admiral Hilary P. Jones, Gen. Robert Lee Bullard, Commander Kenneth Whiting and Lieut.-Commander Zachary Whiting.

Sir Hugh M. Trencherd, British Air Minister, also was present. He was accompanied by Capt. Gloucester Armstrong, British Consul-General; Capt. Stephenson of the cruiser Dauntless and other representatives of the British Government.

After the services the bodies were taken to the navy yard hospital to be prepared for burial. The body of Lieut. Emory C. Coll will be buried at sea in response to a desire which he expressed a short time before the ZR-2 disaster. Three bodies, those of Commander Louis H. Maxfield, Lieut.-Commander Valentine N. Bieg and Chief Machinist's Mate George Welsh will be buried at the Arlington National Cemetery.

Annual Aviators Dinner

The annual aviators' dinner this year will be held as usual on Armistice Night, November 11, 1921, at 7 P. M. in the Commodore Hotel, New York City. A large invitation committee has been formed consisting of one member of each overseas squadron in the Army, the Navy and the Balloon Air Service, together with a delegate from each one of the Flying Fields at home and abroad. These Committeemen have undertaken to get into touch with every member of their old war-squadrons and to secure a full attendance at this year's dinner.

Pilots change their addresses with such frequency that the Dinner Committee has found many of the invitations returned each year by the Postoffice. This is the great aviators' reunion of the year, and it is hoped that every airman who sees this announcement, whether or not he has received his invitation, will communicate with the Armistice Dinner Committee, No. 52 Vanderbilt Avenue, New York City and reserve his seat at the Armistice Reunion Dinner.

Uniforms will be worn and squadrons will be seated together at their own tables. There will be no speakers' table, and no speeches. A number of former enemy aviators, now in New York, have been invited to attend the dinner this year as guests of the Committee.

Steps will be taken to effect a permanent organization of the Veterans of the War-in-the-Air—at this year's dinner. There are nearly 3,000 Aviators living in or near New York, and practically every large city in the country has its local Flying Club, composed mainly of war aviators. It would be an unquestionable advantage to American Aviators to have this great fraternity bound together into one closely united National Association.

The Committee in charge of the dinner is: Lawrence L. Driggs, Chairman, Arthur Hadden Alexander, Gerald Clark Brant, E. Garnsey Brownell, Eddie V. Rickenbacker, Sumner Sewell, Eilliot W. Springs, James B. Taylor, Jr.

Bombing of the Alabama

Just as we go to press it is announced that the Army Air Service has set September 21 as the tentative date for the start of the bombing experiments with the obsolete battleship Alabama. The tests, which are to be even more spectacular than those held off the Virginia Capes recently with one-time German warships as targets, will occupy four or five days.

One of the features of the attack will be night bombing, when aeroplanes with the aid of flares will send missiles from the sky on the battleship. It will be the first time such a thing has been done in America. Gas bombs also will be used.

The battleship Alabama was turned over to the army by the navy for the experiments which will be held in Chesapeake Bay, near Tangier Island, off the Virginia coast.

Virginia Varney, daughter of Walter T. Varney, who flew from San Francisco to Yosemite in a San Francisco Call aeroplane. Also pictured are Mrs. Walter Varney, her mother, and Chief Ranger Townsley

The AIRCRAFT
TRADE REVIEW

Experts Urge Navy to Buy a Zeppelin

Washington—Procurement of a dirigible of the Zeppelin type—from Germany, if possible—to replace the lost ZR-2 and continuation of construction of the ZR-1, now building at Lakehurst, N. J., were recommended September 17 to President Harding and Secretaries Denby and Weeks by the National Advisory Committee for Aeronautics.

Continued production of helium, the new gas used for inflating airships, also was recommended by the committee, which is composed of army and navy officers: Charles F. Marvin, Chief of the Weather Bureau; Orville Wright and Dr. Charles D Walcott, Secretary of the Smithsonian Institute, who is chairman.

The committee's recommendations were drawn up at a meeting on September 15, at which the destruction of the ZR-2 in its relation to the future of airships in the American naval and military establishment was discussed. After this discussion the committee formulated its recommendations as follows:

Whereas, Rigid airships have been primarily developed in Germany as a result of persistent efforts which could not be dampened by failures comparable to the recent destruction of the English-built ZR-2, and the practical application of such airships to useful purposes of war and of peace has been exemplified by the Germans;

And Whereas, the English have prosecuted the development of rigid airships with considerable success, patterning after German designs;

And Whereas, An official investigation is being made in England of the ZR-2 disaster which may determine the proximate cause of the accident itself, the conclusion is certain that whatever was the primary cause of the accident, the use of hydrogen was a contributing cause to the great loss of life.

And Whereas, America possesses the only large store of helium which is known to exist, by the use of which airships can be more successfully developed by America than by any other country for commercial as well as military purposes;

And Whereas, the present program of the United States in regard to the construction of rigid airships can be regarded only as extremely conservative;

And Whereas, It would be contrary to the true American spirit to abandon a conservative program because of one serious accident, when it is possible, by studying the cause of the accident, to profit by any mistakes that were made;

Therefore Be It Resolved, That the National Advisory Committee for Aeronautics is of the opinion that the development of rigid airships should be continued in this country; that sufficient funds should be devoted to experimental work for the obtaining of definite information regarding the strength qualities of materials and girders used in the construction of airships, and for the development and checking of the theories used in the general design of airships; and that the present program for the construction of the airship ZR-1 and for the production of helium should be prosecuted with renewed vigor;

Resolved Further, That the National Advisory Committee for Aeronautics believes it advisable that the Government of the United States should secure a recent type of German rigid airship, preferably directly from Germany, to fill the vacancy in the program caused by the loss of the ZR-2.

Balloons Start in Gordon Bennett Race

Brussels — Under intermittent showers and strong easterly winds the fourteen contestants in the balloon race for the James Gordon Bennett Trophy started on the afternoon of September 18.

The big gas bags went away at intervals of ten minutes. The English balloon Banshee, piloted by the English aeronaut Baldwin, was sent off at 4:20 P. M. with the wind blowing between thirty and forty miles an hour. The strong wind gave the pilots considerable trouble, and Uselli, the Italian entrant, withdrew owing to damages to his balloon.

Ralph Upson, American, in a balloon lent to him by Lieutenant de Muyster, a Belgian aeronaut, was the third to get away and disappeared in a south-westerly direction. Lieutenant de Muyster's balloon was the Belgica I., with which he won the race from Birmingham, Ala., in 1920, flying to Vermont.

Bernard van Hoffman, flying the City of St. Louis, got away at 4:05 P. M. and Wade T. van Ormand, in the City of Akron, at 4:30 P. M.

The balloon of the French aeronaut, M. Biernaime, was damaged, but he was able to start.

When the Belgian entrant, Belgica, started, a soldier became entangled in the ropes. He was unable to extricate himself and was carried aloft as the gas bag ascended. The spectators below watched the soldier hanging to the rope, swaying in the wind, as Lieutenant De Muyster and his companion in the basket slowly hauled him to safety just as the balloon disappeared among the clouds.

Aeronautic experts say that the extra passenger in De Muyster's car will prove a handicap to him in the race, as it probably will be necessary for him to throw over his ballast before his opponents are required to do so.

Owing to the direction of the wind the aeronauts are likely to be carried over the English Channel or the Atlantic Ocean. Some of the experts think there is a possibility of the contestants landing either on the Cornwall, England, or Brittany coasts, and some are of the opinion that the gas bags may be driven as far north as Ireland.

May Replace the ZR-2

LONDON—Reports that the American and British Governments may arrange for the transfer of one of Great Britain's remaining airships to American ownership, to replace the wrecked ZR-2, have received some credence in American official circles here, where it is stated that the American Government, some time before it contracted for the ZR-2, considered the desirability of obtaining one of the former German Zeppelins for experimental and instructional purposes.

When these German air fighters were turned over to the Allies, Italy, France and England received one each and America none. Great Britain's Zeppelin, the L-71, is the largest rigid airship in existence, now that the ZR-2 is gone. Her cubic capacity is 2,420,000 feet, or 380,000 feet less than the ZR-2. The length of the L-71 is 743 feet, as against 695 feet for the ZR-2.

New Cuban Field

An emergency landing field has been located on the Isle of Pines, south coast of Cuba, the center of which is about 3 miles 143° from the extremity of Barcos Point. This field is about 2 miles long, northeast and southwest, and 1 mile wide, flat and level, except that in spots small ruts 6 to 8 inches deep are found, which can be seen from aloft. The field is covered with short grass about 2 inches high. The surface is extremely hard in dry weather; it absorbs rain very fast and therefore is suitable for landing at any time except perhaps within two hours after a heavy rain.

Two steel towers, 80 feet high, in line northeast-southwest and 4½ miles apart, have been erected for survey purposes. The line joining these towers crosses the landing field.

There are no obstacles to approach or take off. The surrounding territory is swampy toward the coast and wooded inland.

Small parts can be made and machine work done at the garages in Nueva Gerona, 10 miles to the eastward. Fresh water can be obtained from wells about 2 miles distant and from farmhouses.

Food can be had at Nueva Gerona; trucks are available there and gasoline also. There are no telephones or railroads on the island. There is a radio station at Nueva Gerona and a mail boat leaves there every other day for Batabano, which is connected by rail with Habana.

The prevailing wind is from southwest, force 2 to 3. The rainy season begins between June 15 and July 1 and ends October 15 to 30.

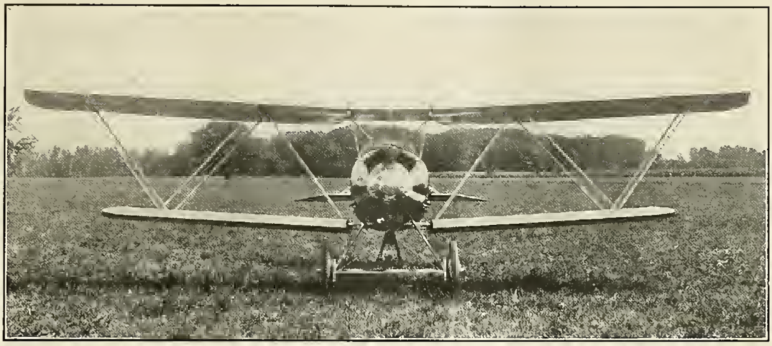
Approximate position of Barcos Point: 21° 55′ 00″ N., 82° 55′ 00″ W.

Electro-Magnetic Brakes for Aeroplanes

(*Concluded from page* 57)

If the rolling of the boat and the wind is very strong, he will use more power, or else he can "flash" the electro-magnets. By this is meant to overload the electro-magnets 50 to 100 per cent. Thus, an electro-magnet usually capable of attracting a weight of 100,000 lbs., can be energized by using double the quantity of the current to give a tractive effect of over 200,000 lbs. Naturally this would be only for half a minute or so, as otherwise there would be danger of burning out the windings. However, inasmuch as the aeroplane makes a landing in less than ten seconds, the "flashing" of the electro-magnets is of no consequence. As soon as the aeroplane has come to rest the blue-jackets will be ready to lash it fast, and then the current can be switched off.

THE NEW LONGREN BIPLANE


Front view of Longren biplane equipped with Lawrence motor

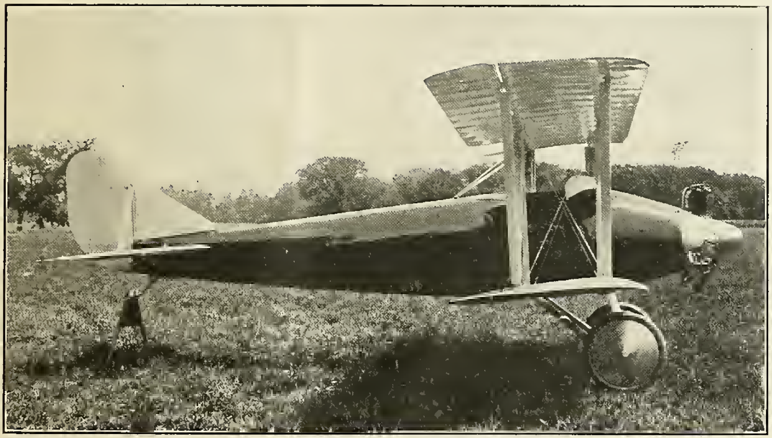
WE illustrate and describe this week the new Longren biplane, designed and manufactured by the Longren Aircraft Corporation, of Topeka, Kansas.

Fuselage

The fuselage is made of hard vulcanized fibre molded to a good streamline form. The fibre is fastened on the top and the bottom center lines to two ash longerons. The fibre is reinforced with laminated ash ribs, giving an exceptionally strong and rigid assembly that is resilient and shock resisting. The fibre used has a strength weight ratio double that of plywood or veneer and cannot be splintered or shattered. The combustion point of 650° F. is an added advantage over wood or fabric covering, and makes it practically fireproof. The fuselage is thoroughly water-proofed inside and outside after assembly. The cockpit opening is well reinforced with ash ribs. The side door, while permitting easy entrance and exit, is designed to preserve the full strength of the fuselage at this point.

Wings

The U. S. A. No. 2 Wing Section, slightly modified, is used. This section is especially adaptable for a commercial aeroplane of this size. The internal wing construction conforms to the best engineering practice. The spars are built up "I" sections of spruce. The ribs are made with plywood web and ash cap strips. Fittings are well standardized and interchangeable. Ailerons are fitted on the upper wing only and are interchangeable. Aileron control is by torque tube with the operating arm in line with the rear hinge of the wing. Swivels are provided on the arms to allow the wings to fold without affecting the controls. The center section is supported by four short struts and braced by streamline straps in front and a "V" tube at the rear.


Side view Longren biplane

The Warren Truss system is used and is so arranged as to allow the wings to be folded without disturbing the setting of the wings or controls. No adjustments are required for the operation. Four fitting pins are unlocked and removed and the wings folded back. For towing, the wings are braced to the body with tubes provided for the purpose. This eliminates danger from rough roads. The plane when folded can be towed behind a car from landing field or garage without damage. This folding wing feature, developed after considerable study and exhaustive experiments is by far the best solution to the housing problem ever offered.

The Empennage

The tail surfaces are made thick enough to require a minimum of external bracing, only two braces being used, and no wires. Rudder and elevators are operated by torque tube. The torque tube also acts as the front spar of these controls, the same as in the ailerons. The elevator controls are entirely enclosed in the body and the rudder control has a short arm and only a very short wire exposed. The elevators are interchangeable and also the two halves of the stabilizer. The tail skid is of the steel leaf spring type, well faired, and fastened to the lower longeron directly under the last body rib. The compression load of the skid is carried by a duralumin compression plate. The skid is of a very neat and compact design, giving maximum strength with minimum resistance.

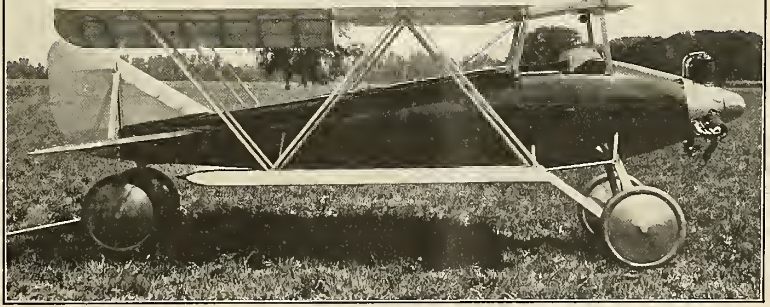
Landing Gear

The landing gear is exceedingly neat and simple in design. The streamline struts terminate at the lower end in the duralumin shock absorber housings which entirely enclose the shock absorbers. The axle is faired to give a lifting section. The leading edge of the axle fairing is used as the compression member between the landing struts. The trailing edge is attached to the axle and rises and falls with it. Both the leading and trailing edges are of duralumin. The tension members of the landing gear are streamline straps. The wheels are faired with duralumin sheet, giving a light but stiff and durable fairing.

Seats and Controls

The cockpit is entered through a side door which is designed to retain the strength of the body. The pilot and passenger sit side by side on a neatly upholstered seat of comfortable width. The seat is the same width as the Standard Pullman seat, and is well cushioned.

The standard stick and foot-bar controls are convenient for instruction and are carefully arranged to leave no moving or unsightly parts exposed. This arrangement makes a very clean and roomy cockpit with no danger of the pilot or passenger's clothing catching on any part. The aluminum instrument board is in plain view of both the pilot and passenger and carries all instruments and engine controls. These instruments include a tachometer,


Longren Biplane with wings folded

altimeter, map case, clock, gasoline gage, oil pressure gage, motometer, engine switch and engine control lever.

Baggage space is provided under the seats. A well made windshield completes the comfort of the occupants.

Engine

An Anzani six-cylinder radial air-cooled motor is bolted directly to the substantial plywood nose panel of the body, giving a strong simple mounting. The engine cowling continues the pleasing lines of the fuselage, leaving only the ribbed portion of the cylinders exposed to the air. The model illustrated is equipped with a Lawrence engine.

Specifications

Span—Upper Plane	27'-11"
Span—Lower Plane	21'-11"
Length—Overall	19'-0¼"
Wing Section, U. S. A. No. 2 slightly modified	
Height	7'-8"
Chord—Both Planes	4'-3"
Gap	4'-3"
Incidence—Upper Plane	3°
Incidence—Lower Plane	2°
Decalage	1°
Dihedral	3°
Incidence—Stabilizer	1½°
Motor and Horse-power, Anzani air-cooled radial 60 H.P.	
Weight, empty	550 lbs.
Weight, fully loaded	1,050 lbs.
Useful Load	500 lbs.
Areas—	
Wings, including ailerons	189.0 sq. ft.
Ailerons (2)	19.1 sq. ft.
Stabilizer	13.5 sq. ft.
Elevators (2)	11.4 sq. ft.
Fin	2.6 sq. ft.
Rudder	5.6 sq. ft.
Weight per square foot	5.55 lbs.
Weight per horse-power	17.5 lbs.

Overall Dimensions, Wings Folded—

Length	19'-0¼"
Width	9'-8"
Height	7'-2"

A MONEY-SAVING FORD ACCESSORY

IN view of the fact that every flying field has its army of "flivvers" we have thought it desirable to bring to the attention of our readers a new device which has been developed, and which has given remarkable results in increase of power and saving of gasoline.

The illustration shows the Simpson Flexeco "30" which consists of a brass cone-shaped device and a spiral spring.

The object of the device is to break the gas up into the finest possible vapor, and thus improve the operation of the motor.

At 20 miles per hour the position of the Flexeco "30" would be as shown in this cut, some vapor passing up through the chamber inside the cone, and more vapor whirling up around the outside of the cone. The vapor passing through inside of cone is thoroughly broken up by slot-shaped ports. The vapor passing up on outside of cone is broken up by whirling motion and by striking deflecting flange at top of cone.

At speed greater than 20 miles per hour, the cone lifts still higher, due to increased suction from the motor, and allows an additional amount of vapor to pass up around outside of the cone.

At slow speed, the spiral spring holds cone down so that the flange at top of cone rests on shoulder of carburetor chamber, thus closing the opening around cone and forcing vapor to pass through inside of cone.

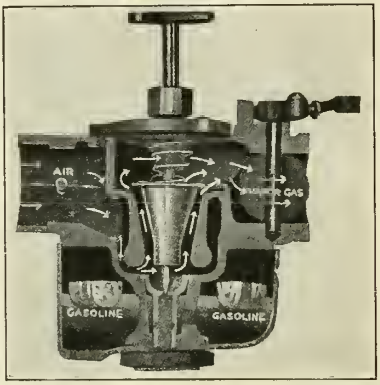
This device automatically regulates the gas mixture, so that maximum efficiency and gasoline saving is being obtained at all time thus increasing the mileage 30% to 50%.

The device is being distributed by the Pyrene Manufacturing Co., 17 East 49th Street, New York, who have received the following communication concerning tests at the Polytechnic Institute:

Gentlemen: I beg to submit to you the results of road tests made to determine the merits of your attachment for the Holley Carburetor. The carburetor adjusted on both sets of trials so that the mixture was as weak as permissible and still retain the full hill-climbing power of the motor. During the tests with your device your needle was ½ turn open and with the regular Holley needle was ⅝ turn open, these being found by trial to be the smallest permissible openings.

Results of Tests

1. *Driving characteristics.* In acceleration your device showed superiority particularly on lean mixtures, there being no sign of hesitation and absolutely no backfiring when the throttle was suddenly opened wide. This was not true with the regular Holley Carburetor.



Standard Ford Holley carburetor with Simpson Flexico device installed

Details of the Simpson Flexico device

2. *Driving at slow speeds.* In driving at speeds below 10 miles per hour, your device far excelled the regular Holley, the car driving in high gear at 4 miles per hour without a hitch on a 5% grade. With the standard Holley needle the best was 7 miles per hour on the same grade.

3. *Mileage tests for economy.* These tests were run over exactly the same courses and at the same rates of speed for both sets of tests, and I believe are as accurate as it is possible to make road tests. The results are tabulated below:

Table of Results of the Simpson Flexeco "30" and Standard Holley Carburetor

1. Speed, miles per hour	10	15	20	25	30	
2. Your device:						
a. Miles per Gal. June 11	32.4	36.6				Dry road
b. Miles per Gal. June 13	30.	32.7	32.9	31.	29.1	Wet road
3. Regular Holley Carburetor:						
a. Miles per Gal. June 13	29.5	25.3	24.2	24.4	23.5	Dry road
Based on the above figures the increase in mileage is:		29.3%	36.0%	27.0%		

The average of the above three figures is 30.8 per cent. The above speeds were chosen as they represent average driving speeds. During the tests all measuring apparatus was carefully checked. The gasoline cocks were tested and found to be absolutely tight.

In answer to your questions, as to our opinion as to the most valuable features of your device, we believe the smoothness you add to the Ford motor—the better acceleration—increase in power—ability to idle at 4 miles per hour against Holley 7—are quite important as features, if not equal to the economy shown by the use of your device.

Respectfully submitted,
(Signed) WILLIAM J. MOORE,
Prof. of Experimental Engineering.

ELECTRO-MAGNETIC BRAKES FOR AEROPLANES

THE Australian publication "Sea, Land and air" prints an interesting article in a recent issue under the above caption. Whether Mr. Gernsback's invention is a practical one is a matter for the future to determine, but should it fulfill the claims put forth by him it will not only introduce a great element of safety in flying, especially with reference to night flying, but will go a long way towards simplifying the operation of aeroplanes from battleships.

It is a well-known fact that when the aeroplane was first brought out by the Wright Brothers, of Dayton, Ohio, one of the greatest troubles they experienced was in making a safe landing. At first wooden skidding arrangements were used, while afterwards heavy rubber pneumatic tires came into vogue to take up the shock when the aeroplane alighted.

When an aeroplane lands on a plain or a large grass plot and it comes to rest, the danger is, of course, over. As aerial science is progressing, however, and as aeroplanes are forced to alight sometimes on very narrow platforms, the landing becomes more and more dangerous due to the smaller and smaller landing area which economic conditions make necessary.

It is safe to predict that during the next twenty years our entire mode of life will have been revolutionized. Aeroplanes within ten years from now, particularly during the period of reconstruction after the late war, will become as plentiful as automobiles. The landing problem, therefore, becomes more and more important, and it goes without saying that when aeroplanes alight in a crowded city, they will not have large grass plots on which to land. Naturally, the roofs of our tall buildings immediately suggest themselves. Nor is this a new idea. There exists today in Philadelphia a hotel, the Bellevue-Stratford, which has a landing platform on its roof. But this platform has never been utilized as yet, for the good reason that it has been too dangerous, the landing area being too small.

Up to this time there has not existed a device whereby it was possible to make a landing on a small plot for the reason that when an aeroplane comes out of the sky it cannot stop instantly. Its momentum usually carries it forward as much as 100 yards. Were the aeroplane to stop abruptly, it would naturally turn either a somersault or otherwise would become wrecked. The same thing only on a smaller scale happens to an express train going at sixty miles an hour when the emergency brakes are set abruptly without the brakes gradually taking up the momentum of the train.

Recently it has been proposed to stop the momentum of aeroplanes by having them land on a wide strip of belting revolving in opposite direction to the oncoming flyer. While this idea is feasible it has never been used in practice, and it becomes obvious that it could not be used except from one direction. For instance, if the aeroplane came on at right angles to the moving belt, it would most likely be overturned. For that reason this device may be considered as impractical. Of course, when the weather is clear and the wind velocity is not great, an expert aviator will not have much trouble in alighting on a comparatively narrow runway as has been proved right along by seaplanes making successful landings on battleships. At present our Navy has quite a few battleships equipped with narrow runways as explained above, but these are useless in a heavy sea, or when a gale is blowing. The reason is that even if the aeroplane should make a successful landing, it would almost surely be tossed into the sea by the combined pitching and rolling motion of the vessel, as well as by the wind trying to blow the aeroplane into the ocean. Quite a number of accidents have happened in the past, due to these causes, and no doubt will happen in the future until some remedy is found.

Mr. H. Gernsbach, who has given this problem consideration, seems to have found an astonishingly simple solution whereby it now becomes possible for an aeroplane to make a landing on a very small area, no matter what its speed. The present invention on which patents are pending, is described herewith. Mr. Gernsbach has also offered his invention to the Navy Department in connection with hydro-aeroplanes alighting on battleships at sea.

To grasp the idea clearly one has to picture a future landing station "somewhere in the city of New York," on which a transatlantic aeroplane is just settling; the landing platform in this case being constructed of a very heavy glass. Into this glass, which by the way is transparent, are sunk a number of large powerful electro-magnets such as are commonly used for lifting purposes. The idea of the transparent glass is that powerful searchlights can be placed underneath it, and the entire glass expanse therefore will stand out sharply from its surroundings. Thus, an aeroplane from a considerable height will see the landing platform readily by night.

The electro-magnets in this case would be quite large, say fifty or sixty inches across, each being capable of attracting about 200,000 pounds. These electro-magnets are by no means futuristic ideas. Large electro-magnets are being built right now that can lift anywhere from eight to ten tons at contact.

In further explanation of Mr. Gernsbach's idea, it must be realized that the aeroplane has two iron-armoured pontoon-like projections instead of the usual wheels, or instead of the usual boats as are used on hydro-aeroplanes. It now becomes apparent that as the aeroplane comes within a few feet of these energized electro-magnets, there will ensue a powerful electro-magnetic attraction between the electro-magnets and the iron pontoons of the aeroplane. The tendency will be to pull the aeroplane down into contact with the electro-magnets, but inasmuch as the flying machine still has considerable momentum, it will not stop at once, but will glide over a number of electro-magnets until it finally comes within a few inches of the last row of electro-magnets when the maximum tractive effect will be had. The aeroplane will then be pulled down entirely so that the pontoons come into actual contact with the huge electro-magnets, completely arresting the flight of the aeroplane.

Now it must be understood, and it should be realized that these electro-magnets have no effect whatsoever upon the iron pontoons *until the latter come within two or three feet of the electro-magnets*. A metallic mass must come quite close to an electro-magnet before any appreciable attractive effect is had. From this it will be gathered that this invention does not purport to pull the aeroplane "out of the sky" as some people might think. It does not do anything of the sort. The idea simply is to arrest the motion of the aeroplane while in the act of landing and then hold the machine securely. If these electro-magnets were not used, then it undoubtedly would often happen that the aeroplane could not stop quickly enough, and in this case it might slide over the edge of the landing platform down into the streets. Also, while making a landing in a gale, such a huge machine, which necessarily must have a large wing area, becomes a toy of the elements; even if it had completely stopped, the wind might carry it away before the commander would have time to get the engines running at full speed. All this the electro-magnetic brakes will prevent. Once the aeroplane has settled, the electro-magnets will hold it as securely as if it had been riveted to the platform. Then after the landing has been made, the aeroplane can be readily secured to the platform by guys or ropes, so that the winds or storms cannot carry it away; this being only a matter of a few minutes, the power can then be turned off from the electro-magnets and no current is then used.

Another important point worth remembering is, that as the iron aeroplane pontoons fly a couple of feet above the electro-magnets the tractive effect, while not abrupt, is sufficient to retard the motion of the aeroplane gradually, and the electro-magngets in this respect will act exactly as the reversing of a ship's propellers in the water. In other words, the momentum of the aeroplane will be absorbed gradually and not suddenly. Furthermore, the pontoons may be equipped with small wheels, just extending a little distance from the lower surface if this is desired. Or, otherwise, the glass landing platform may be greased by means of some form of lubricant. If either of the two precautions were not taken, there would almost certainly ensue a terrific "grinding" action when the pontoons finally settled on the platform, and when the aeroplane was still in motion. However, these are small technical details left to our engineers; there are at present a number of simple means to effect a smooth final landing without the grinding element contained in it due to excessive friction.

One can readily realize how the invention can be adapted to hydro-aeroplanes making a landing on battleships and the like. As mentioned before, such landings at present are very dangerous, and often disastrous. The electro-magnetic brakes will do away with all this, and once a landing has been effected it will be almost impossible for the aeroplane to leave the narrow landing stage no matter how much the ship pitches, or what the wind velocity is. If the iron pontoons of the hydroplanes only engage two electro-magnets, an enormous tractive effect anywhere from two hundred to four hundred thousand pounds can be readily obtained. It is easy to realize how the invention works out in practice. As soon as the operator who is in control of the electro-magnets sees the oncoming aeroplane, he has it in his power to gradually switch on current into the electro-magnets. Thus, for instance, the two foremost electro-magnets can be energized but half or one-quarter if required, so as not to jerk the aeroplane or stop it too soon. In other words, a gradual braking action can be had at the will of the electrician in charge.

(Continued on page 54)

A NEW METHOD OF TESTING MODELS IN WIND TUNNELS

By W. MARGOULIS
Aerodynamical Expert, Paris Office, N.A.C.A.

WE know that the two essential conditions of the application of the law of proportionality of pressure to the product of density, the square of the linear dimensions and the square of the speed to the results of model tests are:

(1) *The Equality of Reynolds' Number.*

$$N = \frac{vl}{\nu} = \frac{VL}{\nu_1}$$

v being the velocity of the airstream in the tunnel, V being the speed of the machine in free flight, l and L—respectively one of the principal linear dimensions of the model and of the full scale aeroplane; ν and ν_1—respectively the kinematic coefficients of viscosity of the fluid circulating in the tunnel and of the air in which the machine flies.

(2) *The Equality of the Ratios of the Speed to the Velocity of Sound* (Law of Bairstow and Booth).

$$M = \frac{v}{w} = \frac{V}{W}$$

w and W being respectively the velocities of sound in the tunnel and in the air.

The first of these conditions is due to viscosity and is important especially at low speeds (tests of model aeroplanes); the second condition is due to the consideration of compressibility and must be observed at high speeds (tests of model propellers).

Now, in existing laboratories utilizing a horsepower of 100 to 300, the models are generally made to a 1/10 scale and the speed is appreciably lower than the speeds currently attained by aeroplanes; the Reynolds' Number realized in the laboratories is thus from 15 to 25 times smaller than that reached by aeroplanes in free flight, while the ratio M varies between the third and three-fourths of the true ratio.

Thus, when a model aeroplane, for instance, is tested in such a laboratory, the streamline wires resist relatively twice as much, the struts of the rigging and undercarriage five times as much, while the wings carry 30% less on the model than on the aeroplane, so that *results obtained in existing laboratories cannot be practically utilized.*

We cannot appreciably increase Reynolds' Number by increasing either the diameter (d) of the tunnel, or the velocity v of the airstream, for the motive power required for working the fan producing the airstream is proportional to $d^{1.75}v^{2.75}$ and such increase would therefore lead to installations much too costly both as to establishment and upkeep.

Thus wind tunnels are now being planned having a diameter of 3 to 5 m., speeds of 60 to 75 m/sec., and horsepower of 1000 to 1500; but the Reynolds' Numbers attained in such tunnels will still be 8 times less than those of existing large aeroplanes.

We will show, however, that it is possible to have wind tunnels in which Reynolds' Number will be greater than that now attained by aeroplanes, and in which the ratio of the velocity to the velocity of sound will also be greater than that realized in practice, and we will show that this can be done with an outlay for installation and upkeep much below that required by the laboratories now being planned.

In order to attain this result we have only to employ a gas other than air, at a pressure and temperature different from those of the surrounding atmosphere.

We will establish the expressions connecting the power:

1st. To the physical constants of the gas.
2nd. To the values of the temperature and pressure.
3rd. Either to Reynolds' Number, or to the speed of the aeroplane in free flight, or to both these values simultaneously.

1. Fundamental Formulas

We will call:

v and d respectively the speed and the diameter in the working section of a tunnel.
μ the coefficient of viscosity at the absolute temperature T.
ρ — the density; ρ_0 — density at 1 kg/cm² and 273°.
ν — the kinematic coefficient of viscosity; $\nu = \mu/\rho$.
p — the pressure.

It can be shown† that the power drop in a closed circuit wind tunnel proceeds from two causes:

The units employed are the kilogram (unit of force), the meter, and the second.

We assume with Prandtl* that the power drop for any fluid whatever in a cylindrical conduit of length L, is:

$$\Delta = a\,L\,\mu^{0.25}\,\rho^{0.75}\,v^{1.75}\,d^{-1.25}$$

1st. The drop caused by friction, expressed in the form:

$$P_1 = A\rho\,.\,d^2v^3\,.\left(\frac{\mu}{\rho\ d\ v}\right)^{0.25} = A\,\rho\,d^2v^3\,.\,N_s^{-0.25}$$

(N_s being the Reynolds' Number of the tunnel.)

2nd. The second cause of power drop is the thickening of the airstream in the diffuser and the loss by impact in the bends:

$$P_2 = B\,\rho\,d^2v^3$$

If we consider that these latter losses are very small as compared with those arising from the first-named cause, we can assume as an expression of the total power drop:

$$P_1 + P_2 = \rho\,d^2v^3\,.\,N_s^{-0.25}\left(A + B\,N_1^{\,0.25}\left(\frac{N_s}{N_1}\right)^{0.25}\right) =$$

$$= \rho\,d^2v^3\,N_s^{-0.25}\,(A + B\,N_1^{0.25}) = C\,\rho\,d^2v^3\,N_s^{-0.25}$$

N_1 being the mean value of N in the tunnel.

If we take as a basis the results obtained in the closed circuit tunnel of the Aeronautical Institute of Rome (50 m/sec. in a flue of 2 m. diameter with 113 h.p.; coefficient of utilization $\rho^s = 2.9$) for determining the value of $(A + B\,N_1^{\,0.25})$, we shall come to assume as an expression of the motive power required for working the fan of a tunnel of this type utilizing any fluid whatever:*

$$P_m = 0.47\ \mu^{0.25}\ \rho_0^{0.75}\,.\,\frac{p^{0.75}}{T^{\,0.75}}\,.\,v^{2.75}\ d^{1\,75} \qquad (1)$$

We shall compute the Reynold's Number for the tunnel by assuming that the span of the model is equal to 6/10 of the diameter of the flue:

$$N = \frac{0.6\ vd}{\nu} = 0.0164\ v\ d\ .\ \mu^{-1}\ \rho_0\ p\ T^{-1} \qquad (2)$$

The velocity of sound being equal to $\sqrt{\gamma\frac{p}{\rho}}$ where γ is the ratio of the specific heats, the condition of the constancy of the ratio of the speed of translation to the velocity of sound, leads to the expression:

$$v = 0.0183\ .\ \rho_0^{-0.5}\ \gamma^{0.5}\ T^{0.5}\ V \qquad (3)$$

v being the velocity of the fluid stream in the tunnel and V the speed of the aeroplane in air at 273° and at a pressure of 1 kg/cm.²

Equations (1), (2), and (3) enable us to establish the following expressions for the power required for working the fan.

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† See in the last publication of the Eiffel Laboratory: "Résumé of principal works executed during the War," p. 184, my theory of the functioning of wind tunnels.

* "Abriss der Lehre von der Flüssigkeits und Gasbewegung," p. 20.

* The following table gives the values of the coefficient of viscosity μ_0 at 273° absolute, of the density ρ_0 at 273° and 1 kg/cm² pressure, of the kinematic coefficient of viscosity ν_0 at 273°, of the ratio γ of the specific heats at constant pressure and volume, and of the coefficient C of Sutherland's formula, giving the value of the coefficient of viscosity μ at the absolute temperature T of the gas.

$$\mu = \mu_0\,\frac{1 + C/273}{1 + C/T}\sqrt{\frac{T}{273}}$$

	$\mu_0.10^6$ (kg. sec/m²)	ρ_0 (kg. sec²/m⁴)	$\nu_0.10^6$ (m²/sec)	γ	θ
Air	1.69	0.127	13.3	1.4	114
CO₂	1.4	0.195	7.18	1.264	260
CH₃ Cl (chloride of methyl)..	0.99	0.251	3.94	1.2	454
Xe (xenon)	2.18	0.561	3.89	1.667	
Water	1.81	1.02	1.78	2.0830	

For water we have calculated the value of γ so as to be able to express the velocity of sound in water by a formula similar to that used for gas:

$$W = \sqrt{\gamma\frac{P_0}{\rho_0}}$$

For gases, compression and cooling diminish the value of ν, in consequence of the reduction of μ with the reduction of the temperature, and also on account of the increase of ρ; on the contrary, for water the reduction of the temperature increases the value of μ ($\mu = 19.10^6$ for T = 423°, 29.10⁶ at 273 and 183.10⁶ at 273°) while cooling and compression do not appreciably affect the density.

2. 1st Case—Reynold's Number Is Given; Tests of Model Aeroplanes and Airships

Eliminating v from equations (1) and (2) we have:

$$P_m = 37600 \frac{\mu^3}{\rho_0^2} \cdot \frac{T^2}{p^2} \frac{N^{2.75}}{d} \qquad (4)$$

and

$$v = 61 \frac{\mu}{\rho_0} \cdot \frac{T}{p} \frac{N}{d} \qquad (5)$$

Formula (4) shows that the power P_m is proportional to the term μ^3/ρ_0^2 characterizing the fluid, and to the term T^2/p^2 characterizing the conditions of temperature and pressure.

The gas which is practically most suitable to the different conditions laid down by the above formulas and by those which follow, is carbonic acid* (CO_2), as a gas having a low coefficient of viscosity, high density and a low ratio of specific heats.

For air, $\mu^3/\rho_0^2 = 301/10^{18}$; for CO_2, $\mu^3/\rho_0^2 = 72.4/10^{18}$; for $p = 15 \text{kg/cm}^2$ and $T = 253°$, $\frac{T}{T_0} \cdot \frac{p_0}{p} = 0.0618$ and $\left(\frac{T}{T_0} \cdot \frac{p_0}{p}\right)^2 = 0.00382$.

We thus see that for a given Reynold's number and with equal diameter of flues, the use of carbonic acid at 273° and 1 kg/cm² will economize ¾ of the power required with atmospheric air and that compression to 15 kg/cm² and cooling to 253° will reduce this power in the ratio of 1088 to 1, which certainly constitutes a remarkable result.

The speed will be reduced in the ratio of 1.85 to 1 in the first case and in the ratio of 30 to 1 in the second case.

3. 2nd Case—It Is Required to Realize the Same Ratio of the Velocity of Translation to the Velocity of Sound as for a Full Scale Machine Flying at a Speed V.

Eliminating v from equations (1) and (3) we obtain:

$$P_m = 0.000008 \frac{\mu^{0.25} \gamma^{1.375}}{\rho_0^{0.625}} \cdot p^{0.75} \, T^{0.625} \, V^{2.75} \, d^{1.75} \qquad (6)$$

and

$$v = 0.0183 \, \rho_0^{-0.5} \, \gamma^{0.5} \, T^{0.5} \, V^{0.5} \qquad (3)$$

We see that though there is still an advantage in having low values of μ, γ and T and a high value of ρ_0, there is, on the other hand, an advantage in *reducing* pressure.

Thus for $T = 253°$, $\left(\frac{p}{p_0}\right)^{0.75} \left(\frac{T}{T_0}\right)^{0.625} = 0.572$ for $p = 0.5$ kg/cm² and is equal to 0.164 for $p = 0.1$ kg/cm; $\frac{\mu^{0.25} \gamma^{1.375}}{\rho_0^{0.625}}$ is equal to 0.208 for air and to 0.132 for carbonic acid; $\rho_0^{-0.5} \gamma^{0.5}$ is equal to 3.32 for air and to 2.54 for CO_2*.

We see that the use of carbonic acid at 273° and 1kg/cm² reduced the power required by 40% and that if this gas is expanded to 0.5 kg/cm² and cooled to 253°, the power required is reduced by 90%. The velocity in the flue is in this case equal to 0.74 of the speed of the full scale aeroplane.

4. 3rd Case—Reynolds' Number N and the Speed V Are Given.

If it is a question of establishing a new laboratory for well determined values of N and V, we shall employ the following formula obtained by eliminating d and v from equations (1), (2), and (3):

$$P_m = 11.3 \frac{\mu^2 \cdot \gamma^{0.5}}{\rho_0^{3/2}} \frac{T^{3/2}}{P} V \cdot N^{1.75} \qquad (7)$$

and the diameter will be given by the formula:

$$d = 3340 \frac{\mu}{\rho_0^{0.5} \gamma^{0.5}} \cdot \frac{T^{0.5}}{p} \cdot \frac{N}{V} \qquad (8)$$

established by eliminating v from equations (2) and (3).

Formula (7) shows that there is an advantage in reducing temperature and increasing pressure.

For computing *Power* we note that the values of $\frac{\mu^2 \gamma^{0.5}}{\rho_0^{3/2}}$ are $\frac{74.5}{10^{12}}$ for air and $\frac{25.6}{10^{12}}$ for CO_2*.

For $T = 253°$ and $p = 15$ kg/cm², $\left(\frac{T}{T_0}\right)^{3/2} \cdot \frac{p_0}{p} = 0.06$

For computing *Diameter* we note that:

$\frac{\mu}{\rho_0^{0.5} \gamma_0^{0.5}} = \frac{4.01}{10^6}$ for air and $\frac{2.82}{10^6}$ for CO_2* and that for $T = 253°$ and $p = 15$ kg/cm², $\left(\frac{T}{T_0}\right)^{0.5} \cdot \frac{p_0}{p} = 0.0642$.

In a laboratory constructed, when d is determined, we have:

$$P_m = 0.00339 \frac{\mu\gamma}{\rho_0} \cdot T \cdot d \cdot V^2 N^{0.75} \qquad (9)$$

established by dividing formula (7) by formula (8), thus eliminating p.

The value of p will be determined by formula (8), which may be written:

$$p = 3340 \frac{\mu}{\rho_0^{0.5} \gamma^{0.5}} \cdot T^{0.5} \cdot \frac{N}{V d} \qquad (8')$$

For determining the *Power* we note that:

$\frac{\mu\gamma}{\rho_0} = \frac{18.6}{10^6}$ for air and $\frac{9.09}{10^6}$ for CO_2*; the values of $\frac{\mu}{\rho_0^{0.5} \gamma^{0.5}}$ are given above.

We thus see that if we wish to establish a laboratory for well determined values of V and N the use of carbonic acid at 15 kg/cm² and 253° reduces the power required in the ratio of 48.5 to 1 and reduces the diameter in the ratio of 22 to 1.

In a laboratory already built the use of carbonic acid at 253° reduces the power required in the ratio of 2.2 to 1; the pressure should then be equal to 68/100 of the pressure required with air.†

We would point out that the 3rd case rarely occurs in practice; generally we have only to meet the conditions of the first or second case. We wished to treat the 3rd case, however, in order to show the wide field our method opens for aerodynamical researches on the influence, separate or combined, of viscosity and compressibility.

Remark 1.—When, in the formulas giving the value of the power in the three cases considered, we compare the values of the terms characterizing the nature of the fluid, we find that water forms the least advantageous fluid for use in a laboratory, the more so as, being incompressible, its density cannot be varied.

We may remark, however, that heating water to 100° reduces its coefficient of viscosity in the ratio of 6 to 1; in the first case it then becomes more advantageous than air at atmospheric temperature and pressure. On this subject we may say that we consider the use in wind tunnels not only of gas (that is, of fluids for which the temperature of saturation at 1 kg/cm² is below 273° absolute) but also of vapors, which must be heated so that their temperature is above the temperature of saturation at the pressure at which they are utilized. Thus we may consider using water vapor, although its characteristics ($\mu_0 = 0.89 \times 10^6$, $\rho_0 = 0.079$) are not favorable.

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* Other gases, such as chloride of methyl (CH_3Cl) and Xenon would give better results but could not be practically employed. Thus μ^3/ρ_0^2 is equal to 571 10^{18} for water, to $15.6/10^{18}$ for CH_3Cl and to $33/10^{18}$ for Xe. It is evident that in the formulas we must always assume for water $p = 1$ kg/cm² and $T = 273°$.

* $\frac{\mu^{0.25} \gamma^{1.375}}{\rho_0^{0.625}}$ is equal to 1780 for water, to 0.0967 for CH_3Cl and to 0.0557 for Xe; $\rho_0^{-0.5} \gamma^{0.5} = 14.3$ for water, 2.18 for CH_3Cl and to 1.72 for Xe.

* $\frac{\mu^2 \gamma^{0.5}}{\rho_0^{3/2}} = \frac{4600}{10^{12}}$ for water, $\frac{9.34}{10^{12}}$ for CH_3Cl and $\frac{14.6}{10^{12}}$ for Xe

$\frac{\mu}{\rho_0^{0.5} \gamma_0^{0.5}} = \frac{0.124}{10^6}$ for water, $\frac{1.8}{10^8}$ for CH_3Cl and $\frac{2.26}{10^6}$ for Xe.

$\frac{\mu \cdot \gamma}{\rho_0} = \nu_0 \gamma = \frac{37{,}100}{10^6}$ for water, $\frac{4.75}{10^6}$ for CH_3Cl and $\frac{6.48}{10^6}$ for Xe.

† We know that in phenomena into which viscosity enters, and especially in the movement of fluids in ducts, the power drop per unit of length is represented by a formula of the following form:

$$\Delta = a \, v^{2-n} d^{-1-n} \mu^n \rho_0^{1-n} p^{1-n} T^{n-1}$$

It follows that the terms of formulas 4, 7 and 9, characterizing the fluid and the conditions of temperature and pressure, remain the same, whatever be the value of n (according to Prandtl, n = 0.25); only the numerical coefficient and the exponent of N vary. It is the same for all the terms of formulas 3, 5 and 8. In other words, the ratios of the power established in cases 1 and 3, and the ratios of the speeds and pressures established in cases 1, 2 and 3 constitute values independent of the assumed value of n.

Remark II.—In our theory of wind tunnels, we have called the coefficient of utilization of a tunnel (ρ_s), the ratio of the kinetic energy of the fluid stream in the working section to the power of the engine running the fan.

For the closed circuit tunnels which we are studying, this coefficient takes the very simple form:

$$\rho_s = \frac{0.393\ \rho\ d^2\ v^3}{7\ \rho\ d^2\ v^3\ N_s^{-0.25}} = 0.0561\ N_s^{0.25}$$

$N_s = vd/\nu = N/0.6.$

5. Preliminary Project of a Wind Tunnel

As a practical application let us consider a closed circuit tunnel, 2 m. in diameter, utilizing carbonic acid.

For tests of Model Aeroplanes we use carbonic acid compressed to 15 kg/cm² and cooled to 253° and we fix a speed of 30 m/sec. (corresponding, according to formula (3), to a sped in the air of 41 m/sec.).

The power required given by formula (1) will be 300 H.P. and the Reynolds' number realized will be 81.10⁶ and equal to that realized by the largest existing aeroplanes (N is greater for large aeroplanes going slowly than for small planes flying at a high speed). This Reynolds' number will correspond to that of a racing plane flying at 650 km/hr.

The large laboratories now being planned will realize Reynolds' numbers 8 times smaller with powers about 4 times greater . If, in one of these laboratories having a diameter of 3 m., we wished to attain $N = 81.10^6$, we should require a power of 300 × 1088 × 2/3 = 217,000 H.P.*

For high speed tests, and especially for Propeller tests, the pressure must be below 1 kg/cm². Thus formula (1) shows that with carbonic acid at 0.5 kg/cm² and 253°, the speed realized with the same power of 300 h.p. would be:

$$30 \times \left(\frac{15}{0.5}\right)^{0.75/2.75} = 30 \times 2.53 = 76 \text{ m/sec.}$$

equivalent to a speed in the air of 76/0.74 = 103 m/sec., that is 370 km/hr.

If the pressure is reduced to 0.1 kg/cm², the equivalent speed in the air would be 570 km/hr., with an economy in power of 90%; to attain such a speed an ordinary tunnel of 3 m. would thus require $300 \times \left(\frac{3}{2}\right)^{1.75} \times 10 = 6000$ h.p.

Lastly, we would say a few words on the realization of this wind tunnel.

There should be a closed circuit flue with continuous wall formed of thick sheet metal and protected from over-heating. Two doors sliding perpendicularly to the axis of the flue will isolate the working section while the model is being handled. The measuring devices will be placed in an airtight cabin on the wall of the working section, so that the rods of the model supports can traverse the wall of the flue by joints which should not be airtight. The measurements will be registered automatically by apparatus installed either in the cabin and visible from outside, or actually installed outside the cabin. In the latter case the apparatus will consist of manometers connected with dynamometric capsules placed in the cabin. The propeller-fan will have adjustable blades so that it can be adapted to the density of the fluid used in the tunnel.

6. Graphical Representation of the Functioning of a Wind Tunnel of Our System

We will define the functioning of a tunnel by the correlative values of N and V which can be obtained in it.

For a tunnel of our system these values are given by equation (9), from which we deduce:

$$V^2\ N^{0.75} = \frac{P_m}{0.00339\ \nu_0\ \gamma\ .\ T\ .\ d} \qquad (9')$$

For the tunnel 2 m. in diameter, studied above, utilizing CO_2 at 253° we have:

$$V^2\ N^{0.75} = 64500\ .\ P_m \qquad (9'')$$

If in a system of rectangular axes (see Fig. 1) we lay off the values of V in abscissa and the values of N in ordinates, the functioning of the tunnel will be figured by a sheaf of iso-P_m lines.

The scales being logarithmic, this sheaf will be composed of parallel lines.

To each group of values of V and N will correspond a value of p, determined by formula (8'):

$$p = 3340 \frac{\mu}{\rho_0^{0.5}\ \gamma^{0.5}}\ .\ T^{0.5} \frac{N}{V\,d} \qquad (8')$$

or, for the tunnel under examination:

$$p = 74900 \frac{N/10^6}{V} \qquad (8'')$$

The values of p will thus be represented on Fig. 1 by a sheaf of iso-p lines plotted by formula (8").

If we take the maximum value of p to be 15 kg/cm and the minimum value 0.1 kg/cm², the field of realizable values of N and V will be limited:

1st. By the iso-P_m line corresponding to the maximum power of the engine of the tunnel; we have indicated the iso-P_m = 300 H.P. by a heavy line.

2nd. By the iso-p lines corresponding respectively to 0.1 and 15 kg/cm², also marked in heavy lines.

Any group of values of V and N found within these limits may be realized by a tunnel of our system.

The value of N will be determined by multiplying the Reynolds' number of the full scale machine in flight by 0.6/1, 1 being the quotient of the dimension used in determining the Reynolds' number, and the diameter of the flue.

Example.—Test of a 1/10 model of a strut 30 mm. in diameter, of an aeroplane whose sped is 50 m/sec. We have:

$$N_m = \frac{0.03 \times 5^0 \times 10^6}{13.3} \times \frac{06.}{0.003/2} = 0.113 \times 10^6 \times 400 = 45.10^6$$

We see on Fig. 1 that the point $N = 45.10^6$, V ≐ 50 m/sec may be realized with 290 horsepower and a pressure of 7.2 kg/cm².

7. Comparison of an Ordinary Type Tunnel with a Tunnel of Our System

For an ordinary wind tunnel the Reynolds' number N is proportional to the speed V. The functioning of ordinary tunnels will thus be represented by a line parallel to the iso-p lines; the extremity of this line will correspond to the speed determined by the maximum power of the engine of the tunnel.

On Fig. 1 we have drawn the lines corresponding to the following tunnels: Eiffel (E_1 and E_2); St. Cry (C_1 and C_2); National Physical Laboratory (N_1 . . . N_5); Rome (R); Göttingen (G).

The graph shows in a very suggestive way the superiority of our system of tunnel; as a matter of fact, in our system there is much greater scope for variations of N and V (a surface instead of a line) and the power absorbed is much more advantageously utilized.

8. Comparison of the Values of Reynolds' Number and of the Speed of Aeroplanes, Airships, and Propellers with the Values Realized in Our Tunnel

Let 1_a 1_d 1_H and 1_h be the ratios of the dimension of the model used in determining Reynolds' number, to the diameter (d) of the tunnel.

We will assume:

1_a = span of the model aeroplane/d = 0.6

1_d = diameter of model airship/d = 0.15

1_H = diameter of model propeller tested alone/d = 0.5

1_h = diameter of model propeller tested on model aeroplane/d; this value varies according to type of machine.

As in all our computations we have assumed: $N = 0.6 \frac{vd}{\nu}$, the values of Reynolds' number must in each case be multiplied by 0.6/1; thus for aeroplanes $0.61/1_a = 1$; for airships $0.6/1_d = 4$; for propellers tested alone $0.6/1_H = 1.2$ and for propellers tested on a model aeroplane and on its scale $0.6/1_h$ = span of plane/diameter of propeller, so that $N_h = N_a$, which, moreover, was evident *a priori*.

The following table gives the values of N_a, N_d, N_H and N_h for different existing machines, the value of ν being $\frac{13.3}{10^6}$ m²/sec.

Aeroplanes	Span (m)	Speed (m/sec)	$N.10^6$	$N.10^6 \times 0.6/1_a$
Racing Plane (A_1)	6	90	40.6	40.6
Pursuit Plane (A_2)	9	70	47.4	47.4
Medium size transport plane (A_3)	14	55	58	58
Large transport plane (A_4)	25	43	81	81
Giant aeroplane (A_5)	42	35	110	110
Airships	Diam.			$N.10^6 \times 0.6/1_d$
Small flexible airship (D_1)	10	20	15	60

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* This figure must be considered rather as a proof of the impossibility of realizing this Reynolds' number in an ordinary tunnel than as an exact value of the required power. As a matter of fact the speed in this case should reach 900 m/sec. and we have not the right to apply our formulas to such speeds, for which, moreover, the phenomena of compressibility would completely distort the results.

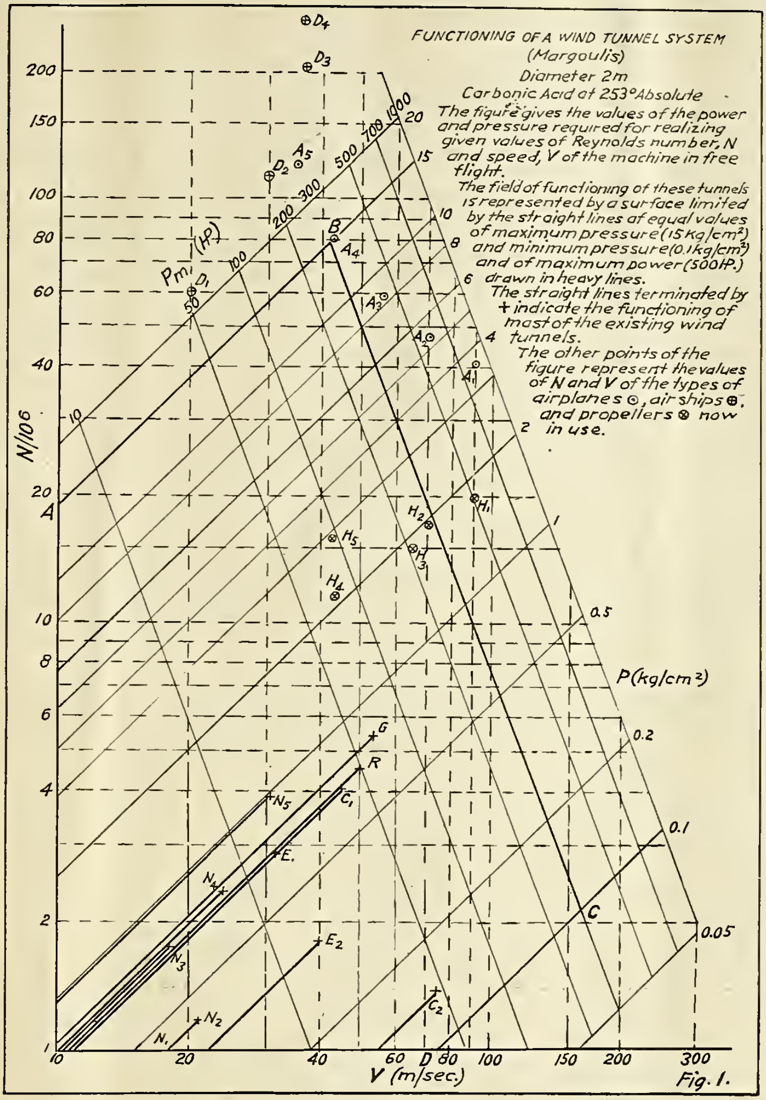


Fig. 1.

Large flexible airship (D_2)	15	25	28.2	113
Transport Zeppelin (D_3).	18.7	36.8	51.7	207
Military Zeppelin (D_4)...	23.9	36.4	65.4	251

Propellers	Diam. (m)	Speed (m/sec.)	$N.10^6$	$N.10^6.\frac{0.6}{l_H}$	$N.10^6.\frac{0.6}{l_h}$
Racing Plane (H_1)	2.4	90	16.2	19.5	40.6
Pursuit Plane (H_2)	2.7	70	14.2	17.1	47.4
Medium size Plane (H_3)	3	55	12.4	14.9	58
Large Plane (H_4).	3	43	9.7	11.6	81
Giant Plane (H_5)..	5	35	13.2	15.8	110

In examining the positions of the points representing the values of N, V for any machine whatever, it should always be remembered that it is of little importance if the model of a low speed machine does not attain the same speed in the tunnel as in flight and also that it does not much matter if a high speed machine does not attain its Reynolds' number in the tunnel.

This being understood, we see that with 300 horsepower we realize for large aeroplanes the conditions of Reynolds' number and speed and that if the speed conditions are not realized for small rapid machines, that is of no importance so long as the Reynolds' number is attained.

For large airships only the half of N is reached, but, considering its very high value, this should not lead to error.

Finally, for propellers tested on the model and on the same scale as the model, we realize, as for large aeroplanes, the conditions of similitude imposed by the considerations of viscosity and compressibility.

For small high speed planes we shall adopt either mean values (for instance, for a pursuit plane; 60 m/sec., 4 kg/cm² and N = 30.10⁶ instead of 47.10⁶) of V and N, or extreme values of V and N according to whether we are studying the functioning of the propeller or of the aeroplane.

Remarks.—In the application just given of our system to a tunnel of 2 m. in diameter, we assumed, in order to deal with a general case, that the carbonic acid was cooled to —20° C.

Practically, this cooling leads to complications in installation and functioning which the resulting small gain of power does not justify—see formulas (), (6), and (7).

We therefore consider it preferable to work at the temperature of the surrounding atmosphere. If we assume a mean temperature of + 10° C, formulas (9) and (8′) show that for the same values of V and N the power is increased by 11% and the pressure by 6%, with respect to those corresponding to a temperature of —20°.

In Fig. 1 the graduations of the lines of equal values of P_m must thus be increased by 11% and the graduations of the lines of equal values of p by 6%.

It follows that the limits of functioning of our wind tunnel will be the same as those given above, on condition of employing 335 H.P. at pressures varying between 0.106 and 15.9 kg/cm².

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Consolidated Statement of the Performance of the Air Mail Service —Fiscal Year 1921 (July 1, 1920 to June 30, 1921)

Month	Trips Possible (Sched'l'd)	Trips Attempted	Trips Defaulted	Trips Uncompleted	Weather Encountered		Mileage Possible (Scheduled Mail Trips)	Miles Traveled with Mail	Miles Traveled Testing, Ferrying, etc.	Total Miles Traveled	Per cent of Performance	Mail Carried (Lbs.)	Cost of Service	Forced Landings Due to	
					Trips in Fog, etc.	Trips Clear								Mechanical	Other Causes
July, 1920	260	253	7	7	40	213	71,500	69,140	4,862	74,002	96.69	68,401	$85,993.59	25	14
August	368	347	21	19	55	292	479,502	73,456	42,567	116,023	92.42	73,140	73,026.93	39	29
	(Transcontinental service inaugurated September 8th)														
September	696	502	194	30	390	112	143,322	105,847	25,355	132,202	73.84	91,150	108,751.76	47	30
October	750	593	157	57	190	403	154,700	123,274	31,212	154,486	79.68	89,541	123,618.68	54	59
November	758	575	183	77	230	345	156,076	114,750	25,009	139,759	73.50	87,302	121,501.18	85	69
December	884	662	222	105	347	315	178,776	127,306	3,734	131,040	71.21	89,942	131,205.96	89	138
January, 1921	850	697	153	87	253	444	171,900	132,679	6,930	139,609	77.18	84,435	136,488.61	117	131
February	782	660	122	71	310	350	159,238	130,431	13,224	143,655	81.90	88,135	131,855.43	82	122
March	918	871	47	59	351	520	185,652	171,593	15,032	186,625	92.42	110,117	152,442.27	64	123
April	684	837	47	36	370	467	178,776	171,156	15,794	186,950	95.73	117,778	147,890.64	79	107
May	850	833	17	20	320	513	171,900	168,397	12,819	181,216	97.96	115,073	125,754.74	72	81
June	832	829	3	10	268	561	168,656	156,956	18,135	185,091	99.00	105,838	127,479.83	57	51
Totals	8,332	7,659	1,173	578	3,124	4,535	1,819,976	1,554,985	215,673	1,770,858	85.96	1,120,852	$1,466,009.62	810	954

Regular service between Omaha, Neb., and San Francisco, Cal. (part of the Transcontinental Route)—started September 10, 1920.

Service between Chicago, Ill., and St. Louis, Mo. (part of the Twin Cities (St. Paul and Minneapolis)-St. Louis Division)—started August 16, 1920.

Regular service between Chicago, Ill., and Twin Cities (St. Paul and Minneapolis) (part of the St. Louis-Twin Cities Division)—started November 29, 1920.

New York-Washington Division was discontinued May 31, 1921.

St. Louis-Twin Cities Division was discontinued June 30, 1921.

Repair Depot, Bustleton, Pa., was consolidated with Chicago Repair Depot, June 30, 1921—Bustleton Field abandoned same date.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Consolidated Report of Operation—Fiscal Year 1921

Month	Gasoline Cost	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles and Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	Interest on Investment	TOTAL
July, 1920	$9,706.72	$1,644.57	$32,658.12	$5,280.67	$3,204.68	$ 910.19	$5,014.24		$7,119.93	$11,774.69		$4,891.07	$3,588.71	$85,993.59
August	13,507.96	2,366.33	10,281.31	3,164.65	3,406.33	1,081.38	5,642.49		10,520.91	13,641.02		4,177.03	5,237.02	73,026.93
September	18,805.41	2,866.66	17,059.07	13,536.60	4,473.52	1,627.13	7,168.20		13,524.08	19,501.90		4,270.51	5,918.62	108,751.76
October	60,959.94	3,840.85	22,571.32	16,264.81	5,827.95	1,813.91	8,501.34		10,989.85	21,204.47		5,448.06	6,196.18	123,618.68
November	17,635.97	3,920.24	18,626.50	16,511.32	5,197.57	2,511.17	9,081.01		16,460.01	19,510.24		6,289.69	5,757.46	121,501.18
December	17,783.40	3,814.04	21,072.46	21,529.14	5,199.62	2,954.73	12,310.29		15,816.07	20,564.00		4,031.01	6,131.20	131,205.96
January, 1921	18,558.44	4,303.29	28,006.76	18,790.86	6,010.07	3,405.32	12,136.21		15,432.13	19,583.76		3,880.59	6,381.18	136,488.61
February	18,823.70	3,824.18	17,689.41	20,464.60	6,581.91	3,904.82	12,025.41		16,246.74	18,388.37	4,744.81	3,775.30	5,386.18	131,855.43
March	22,896.17	4,970.33	33,531.52	17,827.86	6,832.30	3,792.54	11,270.34		17,851.24	19,912.92	4,583.10	3,725.75	5,248.20	152,442.27
April	22,956.61	5,554.75	31,321.32	12,829.73	6,457.85	2,559.12	12,254.29	4,277.72	17,965.49	18,577.71	9,834.41	3,301.64		147,890.64
May	21,752.41	4,870.72	15,217.83	10,551.05	5,666.64	2,277.41	11,868.01	4,484.67	17,708.11	16,595.44	11,184.21	3,578.24		125,754.74
June	19,624.03	4,544.75	27,921.81	8,236.00	3,918.51	1,110.32	9,493.98	4,524.12	18,897.17	17,343.52	8,602.67	3,262.90		127,479.83
TOTAL	$223,010.81	$46,720.71	$275,957.43	$164,987.29	$62,777.45	$27,948.04	$116,765.81	$13,286.51	$178,531.73	$216,598.04	$38,949.20	$50,631.79	$49,844.81	$1,466,009.62

SERVICE AND UNIT COST

Month	Gallon of Gas	Time		Miles Flown	Cost per Hour	Cost per Mile
		Hr.	Min.			
July, '20	31,956	912	42	74,002	$94.22	$1.16
August	39,812	1,477	50	116,023	49.41	.63
Sept.	53,877	1,629	40	132,202	66.72	.82
October	60,010	1,852	56	154,486	66.71	.80
November	50,573	1,651	20	139,759	73.57	.87
December	49,844	1,569	28	131,040	83.60	1.00
Jan., '21	51,427	1,668	51	139,609	81.78	.98
February	68,898	1,733	04	143,655	76.08	.92
March	66,929	2,103	36	186,625	73.18	.82
April	66,854	2,175	04	186,950	67.98	.79
May	64,322	2,041	29	181,216	61.08	.69
June	57,873	2,148	27	185,091	59.33	.69
Totals and Averages	662,175	20,964	27	1,770,658	$71.13	$0.8475

COST PER MILE

Month	Overhead	Flying	Maint'nce
July, '20	$0.24	$0.25	$0.67
August	.17	.23	.23
Sept.	.18	.26	.38
October	.18	.23	.39
November	.21	.27	.39
December	.23	.29	.48
Jan., '21	.23	.27	.48
February	.25	.27	.40
March	.19	.25	.38
April	.18	.25	.36
May	.19	.24	.26
June	.15	.23	.31
Averages	$0.20	$0.25	$0.39

Regular service between Omaha, Neb., and San Francisco Cal. (part of the Transcontinental route)—started Sept. 10, 1920

Service between Chicago, Ill., and St. Louis, Mo. (part of the Twin Cities (St. Paul and Minneapolis)-St. Louis Division)—started August 16, 1920.

Regular service between Chicago, Ill., and Twin Cities (St. Paul and Minneapolis) (part of the St. Louis-Twin Cities Division)—started November 29, 1920.

New York-Washington Division was discontinued May 31, 1921.

Prior to April, 1921, cost of maintaining warehouse was included in "Miscellaneous," and prior to February 1921, cost of radio was also included in "Miscellaneous."

Repair Depot, Bustleton, Pa., consolidated with Chicago Repair Depot, June 30, 1921—Bustleton Field abandoned same date.

St. Louis-Twin Cities Division was discontinued June 30, 1921.

Overhead consists of: Departmental Overhead, Office Force, and Watchmen, Motorcycles and Trucks, Rent, Light, Fuel, Power, Telephone and Water, Interest on Investment, Radio.

Maintenance consists of: Miscellaneous, Mechanics and Helpers, Repairs and Accessories, Warehouse.

Flying consists of: Gasoline cost, Grease and Oil, Pilots.

NAVAL and MILITARY AERONAUTICS

Rockaway Station Stays Another Month

The Navy Department has found ways and means for keeping the Rockaway Park Naval Air Station open another month. Recently Captain Damon E. Cummings, commandant of the station, was ordered by the Navy Department to close down the station. All the seaplanes and blimps were sent to other stations and the officers were preparing to demobilize or transfer the enlisted men.

The decision to give up the air station, which guards the approaches to this city, was based on the refusal of the city to turn over to the navy the land which the station occupies. This land is part of the Jacob A. Riis Park. Hope has been revived that the city may reconsider the Navy Department's request.

General Mitchell Courageously Defends Air Service

A sensational chapter has been added to the "aircraft versus capital ships" discussion that has caused so much comment in Washington this year.

This new development comes from a report made by Brig. Gen. William Mitchell, Assistant Chief of Air Service, published in the New York *Times* September 14, on the bombing tests held two months ago off the Virginia Capes. The report was submitted to Major Gen. Charles T. Menoher, Chief of the Air Service, in the form of a memorandum.

The report has not been issued for publication by the Chief of Air Service. Its appearance is expected to cause a greater sensation than that which occurred in the Air Service administration last Spring when General Menoher warned General Mitchell to "speak softly."

Statements made by General Mitchell in his report flatly contradict the reports submitted by the Congressional committee that witnessed the bombing tests. Those high in political circles believe that there may be a housecleaning in the Air Service when the story "gets around."

The outstanding statements in the Mitchell report are:

Aircraft can operate under conditions when seacraft is helpless.

Aircraft can safely protect the entire coast.

Seacraft should cease operations when within 200 miles of the coast.

All naval activities should be confined to the high seas.

Had the army air service been permitted to attack as it desired, the seacraft attacked would not have lasted ten minutes.

The first provisional air brigade could have put out of action the entire Atlantic fleet in one attack.

The problem of destruction of seacraft by airplane is finished. It has been solved.

The scheme of national defense should be revised at once on the following basis: A department of national defense, with sub-secretaries for army, navy and air service; a department of aeronautics coequal with the Departments of War and Navy must be created at once.

The report stated that at present there is a complete lack of liaison or system about our national defense. It scored the present coast defense system, asserting that at least $1,870,000,000 had gone to create a coast defense that is little more than useless against hostile aircraft and hostile sea forces.

Following are excerpts from General Mitchell's report as published in the *Times:* "Air forces with the types of aircraft now in existence or in development, acting from shore bases, can find and destroy all classes of seacraft under war conditions with a negligible loss to the aircraft. It is not necessary to destroy hostile seacraft at a distance greater than twenty-five miles off shore in order to protect the coast, as this distance exceeds the range of the most powerful guns at present installed. Aircraft, acting from suitable floating airdromes, can destroy any class of surface seacraft on the high seas.

"Conditions of weather affecting the air and sea conditions do not alter the statement made above, as aircraft can operate in conditions under which seacraft cannot operate. There are no conditions in which seacraft can operate efficiently in which aircraft cannot operate efficiently.

"The weapons used in the recent exercises against the seacraft were bombs alone. Torpedoes, gas, gunfire and mines were not employed. The army air service was not permitted to attack the targets, as it would under actual conditions, and never was more than one-tenth of the brigade employed in a single attack.

"Had the army air service been permitted to attack as it desired, none of the seacraft attacked would have lasted ten minutes in a serviceable condition. The first provisional air brigade could have put out of action the entire Atlantic Fleet in a single attack. The value of the airplanes in the first brigade did not exceed the cost of a modern destroyer."

General Mitchell then explains how battle ships under war conditions are much more vulnerable than the targets used in the bombing tests. A battleship with full steam up and speeding ahead is a target much easier to hit and to put out of commission than the targets used, he asserts.

"The problem of destruction of seacraft by forces has been solved and is finished," the report goes on. "It is now necessary to provide an air organization and a method of defending, not only our coast cities, but our interior cities against the attack of hostile air forces. Our recent maneuvers show an enemy having gained control of the air—which gives him control of the sea—may land air forces from aeroplane carriers on any of the islands or keys along our coast, which cannot attack by troops or artillery, and from those points launch air attacks against our great centres of population, extending even to Chicago, St. Louis and other Middle Western cities."

The report then explains how Chicago, St. Paul, Omaha, Kansas City and other cities in the Central West would be laid open to aeroplane attacks and their cities bombed with high explosives and the citizens killed with gas and incendiary bombs.

In conclusion, General Mitchell makes the following recommendations:

1. The establishment of an air force for frontier and coast defense.
2. The equipment of the navy for offenses on the high sea, and not for coast work.
3. Navy control should cease 200 miles from shore, protection of the land and the coast defense being left to the army and the air service.
4. A more co-ordinate and working understanding between the different arms of the service. The present system, a heritage of our early wars, has clearly demonstrated that the present lack of co-operation is a serious fault.

The Alabama Bombing Tests

In a detailed program made public September 17 by the War Department, the objects of the Alabama bombing tests are set forth as follows:

"To determine what explosives or gas effect is needed to put seacraft out of action. It has been demonstrated that seacraft may be utterly destroyed; but obviously, if the system of fire control, communication and mechanical installations of vessels can be disrupted and the nervous systems of the human beings who man seacraft can be shattered, the efficiency of the craft is destroyed without necessarily sinking it.

"To determine the effect of smoke bombs in concealing the attack of aircraft and of the effect of white phosphorus clouds in neutralizing anti-aircraft elements.

"To determine the effect of machine gun fire and fragmentation bombs in clearing the ship's decks of anti-aircraft units.

"To determine the feasibility and effect of night attacks on seacraft."

A board of observers consisting of three air service officers, two ordnance officers and two officers of the Chemical Warfare Service will inspect the results of tests and attacks on the Alabama.

In the preliminary tests a sufficient number of bombs and flares of all types will be dropped to determine the effect of each and the best method of tactical employment. It is anticipated that experiments with tear gas bombs will give important data on the attack of battleships by gas bombs. In similar manner the effect of phosphorous and smoke bombs will be determined. It is believed that smoke screens may be used with great effect in protecting the attacking airplanes from anti-aircraft defenses of seacraft. In order to determine this a series of tests will be held in which the various branches of aviation will make stimulated attacks on the battleship through smoke screens.

The tactical effectiveness of flares in illuminating attack of battleships will be determined in the preliminary tests as well as the effect of white phosphorus in outlining seacraft at night with sufficient distinctness to permit accurate attacks. Tests also will be conducted to determine the effect of the 1,100-pound armor piercing bomb.

FOREIGN NEWS

Aeronautical Commission of Control, Hungary

An Aeronautical Commission of Control for Hungary has been formed with effect from August 1, 1921. Wing Commander J. N. Fletcher, A.F.C., is chief of the British Delegation. The Headquarters are at Budapest. The Aeronautical Commission of Control for Austria ceased to exist from August 1, 1921.

Three French Firms Amalgamate

According to reports from Paris, three of the largest French aircraft firms have joined forces, the new firm to be known as Nieuport-Astra. The three firms are Nieuport, Astra, and Compagnie Générale Transaérienne. There will be few changes in staff in the new firm. M. Delage, who has for a good many years been chief designer and engineer to the Nieuport firm, will remain in this capacity as regards the aeroplane, seaplane, and boat-building departments. The airship department will be under the technical direction of M. Henry Kapferer. M. G. Gradis is chairman of the new company, with M. Thomas as general manager and M. L. Bazaine as commercial manager. The Nieuport machines will in future be known as Nieuport-Delage, much in the same way as the Spads are known as Spad-Herbemont. In this manner there is no possibility of confusing the French Nieuports with the British and other Nieuports which have no longer any connection with the original firm.

Munich Preparing for Air Traffic

The Bavarian authorities are making arrangements to establish a first-class air station at Munich. Discussions between the Federal States have taken place on Munich's favourable situation in relation to the Continental airways.

A Zepp. Hangar for Denmark

The Entente has, writes the *Morning Post* Copenhagen correspondent, offered to sell to Denmark the great Zeppelin shed at Tonder, and probably Denmark will accept the offer. As the removal of the shed is at present too expensive an undertaking for the Government, it intends to leave the structure where it is at present, removing the smaller aeroplane hangar to Copenhagen.

Prague's Second International Aero Exhibition

Particulars of this exhibition to be held from October 22 to 30 next at Prague—originally it was to take place the latter part of September—have now been issued. It is under the patronage of the Czecho-Slovakia President, T. G. Masaryk, and is to be held at the Palace of Industry, Prague, organized by the Ceskoslovensky Aviaticky Club, Praha I. Obecni dum. This second exhibition is a result of the very successful show held in 1920, and it is anticipated that the October exhibition will far surpass last year, and justify the claim of the organizing Club that "Prague is geographically the chief point in Central Europe as well as the center of all Slav commerce, and therefore will certainly hold the leading position in aeronautics." Following the close of the Exhibition, firms will, on November 6, have an opportunity of giving practical proof of the flying powers of their exhibited machines, if they so desire, at the Kbely Aerodrome. Anyone interested in the exhibiting side of this fixture should write for full particulars to the General Secretary, Charles Hypsa at the Club, as above.

Aviation in the Philippines

That interest in aviation is growing in the Philippines is manifest by the letters received at Clark Field recently from the Provinces of northern Luzon.

In compliance with a request from the municipal authorities of Mangatarem, Pan., an officer from Clark Field was ordered to that municipality for the purpose of locating a landing field that could be used the year round.

The officer making this inspection spent several days looking over the different sites and reports a most cordial welcome from the people of Mangatarem. During his stop he was the guest of the Municipal Presidente, Señor Lino Abad Pine, who is greatly interested in aviation. All suitable ground in this district, however, is used in rice culture and would not be available as a landing field more than six months of the year.

The Municipal Presidente requested that several planes land at Mangatarem the date of their annual Fiesta, April 30. Owing to the roughness of the ground it was decided not to chance the breaking of a wheel or a nose-over by landing, but a three plane formation went up and gave the people an exhibition. The population of Mangatarem is estimated at twenty-six thousand, and from the appearance of the crowd from the air it is thought that there were no absentees.

New French Armored Plane

A twin-engined armored aeroplane, designed to protect the pilot and gunners, has recently been designed by Liore and Oliver, a French firm. The purpose of the constructors was to supply the need for an aeroplane properly armored and at the same time light and maneuverable. The power plant of this new plane are two 9-cylinder 180 h.p. LeRhone engines, mounted in a streamline nacelle on each side of the central fuselage, which is constructed entirely of duralumin and is calculated to withstand six times the normal load. A series of tubes forming warren trusses is riveted to the longerons of the fuselage.

The pilot and the gunner, who are in one compartment, are protected by steel plates 0.276 inches in thickness, riveted together. The weight of the armor alone is 661 lbs. The gunner can either remain in his gun ring or seat himself behind the pilot and take control of the machine. To facilitate this, the gun ring is mounted on slides and can be moved backward.

The engines are supplied from a main tank having a capacity of 72 gallons, mounted in the nose of the fuselage, and by two gravity tanks in the top wing. All tanks are leak-proof. There is a pump for each of the gravity tanks, and by turning a tap in the pilot's cockpit one pump can be used for supplying both tanks if the other pump is damaged. Should both pumps be put out of action, the gravity tanks contain enough fuel for half an hour's flight. Each engine is held in place by duralumin tubes attached to the interplane struts and the landing gear.

The plane has a speed at ground level of 114 m.p.h., and at 9,840 feet 108 m.p.h., with a ceiling of from 18,000 to 19,000 feet. The length of the machine is 27.2 feet, span 47.1 feet, height 11 feet and wing area 509 sq. ft. It can carry a useful load of 1,322 lbs.

With only one engine running, the machine has made a series of figure eight turns without losing altitude. In this test the full load of 1,322 lbs. was carried, and a horizontal speed of 62 m.p.h. was made.

The Swiss Air Force

The report of the work of the Swiss Air Force during the year 1920 shows that 12,380 flights were made for a total duration of 3,532 hours. In this number of flights only 8 accidents occurred. No one was injured in these accidents, but there were two deaths as the result of crashes during non-service flights. In the training of airmen in Switzerland, which included an average of 10 hours flying per month, special stress was laid on the development of safety in flying.

Airport for Tokyo

Japanese aviation authorities, it is announced, are making preparations for the establishment of an aerial port near Tokyo. This port is intended to be the first of many aerodromes to be constructed in Japan, Korea, Saghalien, etc. It is to comprise a training ground, landing place, warehouses, customs house, hospital, wireless installations, a signal tower, etc., also equipment for night flying. The fact that this air port will be placed under the control of the Imperial Japanese Aviation Bureau will serve to make it an important military asset in time of war. In time of peace, however, it will be a welcome training ground for civilian aviators who have long felt the necessity thereof.

Aeronautics in China

Excellent progress is being made on the Pekin-Shanghai air line, which consists of six sections—Pekin, Tientsin, Tsinanfu, Nanking, Hsuchow and Shanghai. Between these different stations it is contemplated establishing several landing fields. Pending the completion of the aerodromes at the above-named stations, the Aeronautical Department of China has established a School for Air Service Administration in order to provide administrators for the aerodromes. Students of the school are chosen from among the members of the Aeronautical Department and graduates of the Nanyuan School of Flying. The number of students is 30, and the courses of study which will be given them will embody only necessary and elementary knowledge in air service administration and will be finished in three months. After graduation the students will be sent to the different aerodromes.

The Nanyuan Aircraft Factory has been removed to Tsin-Ho, and 20 Avros and 24 Vimy planes have been transported to the latter place for service in connection with the Peking-Shanghai air line.

The Aeronautical Department has issued an order to the effect that the flying personnel will be subjected to a medical examination every six months. The first examination this year was held in April.

Sadi Lecointe Wins

Sadi Lecointe, the French aviator, won the aviation grand prix at Breavia, Italy, on September 5th, flying 300 kilometers (186.41 miles) in one hour, 13 minutes and 19 seconds. Lieutenant Brakpaha, of Italy, finished second in one hour, 28 minutes and 58 seconds.

French Oversea Service

It is reported that a French syndicate is now preparing to organize an oversea airship service between Marseilles and Algiers and contemplate employing on this line three of the surrendered German airships, the "Nordstern," the L72 and the LZ113. At present there is no direct air line running between Paris and Marseilles, the nearest approach to this being the service between Bordeaux, Toulouse and Montpellier. It is not to be doubted, however, that as soon as the airship service is in operation the Paris-Marseilles airplane route will be opened. As the intention is to run a night service over the sea, probably the aeroplane service from Paris will be so arranged that the machines leave in time to connect with the airship leaving Marseilles in the evening. It should then be possible for a business man to leave London about midday, and, by connecting with the other services at Paris and Marseilles, be in Algiers the next morning.

Colombia Aerial Service

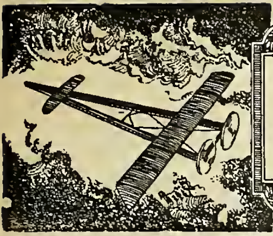
The trip from Bogota to Barranquilla, a distance of nearly 900 miles, can now be made in 21 hours, when it formerly took two weeks or longer. The traveler can go by train from Bogota to Girardot, and from there he can take one of the two new hydroplanes just received by the Colombo-German Aerial Transport Co.—of a better type and greater capacity for conveying passengers than those formerly in use—which will take him down the Magdalena to Barranquilla. A weekly mail and passenger service will be established immediately.

Work has been started on the road to Enea, which will connect the town of Manizales with the aviation field to be established in that vicinity. The field will be 1,000 meters in length, and its total cost will be 50,000 pesos.

First Military School in Ecuador

A presidential decree has created in Guayas Province a military aviation school, the first in the Republic. Fifteen students will be prepared as pilots, 10 as mechanicians and 10 as mechanicians' helpers. Ten civilian pupils will also be received. Two Italian pilots are instructors.

The Condor, a new aviation field, has been opened at Eloy Alfaro, near Guayaquil. One of the aeroplanes is the gift of the Italian colony, another of the Syrian colony, and a third of the university students.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

Woods Used in Aircraft

Sitka Spruce

SPRUCE is the wood "par excellence" for the construction of aircraft. It is light and has greater strength than other woods of similar weight. It is stiff, has a considerable degree of toughness, and can be worked with ease. These properties have made it the most generally used wood for wing beams and struts, and large quantities are employed for longerons, ribs and plywood.

Although there is no great difference in the strength properties of red, white and Sitka spruce, the latter species, on account of its greater size, and consequently its larger proportion of clear lumber, is a more important source of aircraft material than the other two. Because of this and the large supplies of virgin timbers still remaining. Sitka spruce will probably for many years be a very important species in the aircraft industry. The trees reach diameters of from 12 to 15 feet and heights up to 200 feet. Average mature trees are between 4 and 6 feet in diameter and contain from 10 to 15 thousand feet of lumber.

Eastern Spruce

Eastern spruce is also known as red spruce or white spruce. Its use is ideal for the structural parts of aircraft, because in them lightness and ease of working are combined with great strength, stiffness and freedom from hidden defects. The three species do not differ greatly in strength properties, but Sitka spruce produces a larger proportion of clear lumber suitable for aircraft work.

Spruce is used for almost every wooden part of aircraft. Even though its place may be taken to some extent by other woods as the supply of virgin spruce dwindles, it will undoubtedly continue to be a very important aircraft material so long as wood is used for these purposes.

The northeastern spruce does not reach large size. While diameters of from 2 to 3 feet are not uncommon, a great many of the trees in mature areas have diameters between 12 and 18 inches.

Douglas Fir

This species is also known as red fir, yellow fir, Oregon pine, red pine and Douglas spruce.

Douglas fir is a very satisfactory substitute for spruce in making wing beams, longerons, struts and engine bearers, and has been so used to a considerable extent. While somewhat heavier than spruce and more liable to "check" and "shake" during manufacture and in service, in its strength properties it is equal or superior to spruce of the same sizes. The enormous supply available, the large proportion of high grade material, and the high degree reached by the lumber industry in the Douglas firm region, make this species an important source of aeroplane material.

The trees average from 3 to 6 feet in diameter and from 150 to 200 feet in height and many are much larger.

Port Orford Cedar

This species is also known as Lawson cypress, Oregon cedar and white cedar.

While somewhat heavier than Sitka spruce, Port Orford cedar is equal or superior to spruce in all its strength properties. It has been used successfully as a substitute for spruce in making parts where spruce is usually employed.

While this species is satisfactory for aircraft use, the limited supply and small annual output indicate that it will probably not play a very important part of the future development of the aeroplane industry. Trees of this species reach very large size.

Fir

Fir is known by a number of different names. Grand Fir is also known as lowland white fir, white fir, Oregon white fir and silver fir. Silver Fir is also known as lovely fir, amabilis fir, red fir, red silver fir and larch. Noble Fir is also known as larch and red fir. White Fir is also known as California white fir, balsam, and silver fir.

Grand fir is somewhat heavier than spruce and about as strong. Silver fir is also slightly heavier than spruce but practically equal to it in most of its strength properties. Noble fir is as strong as spruce but lighter in weight. White fir is a little lighter than spruce and almost as strong except in shock resistance.

While the firs have not so far been used to any extent in aeroplane construction the first three species named may be substituted for spruce in making wing beams and struts. The other firs are not strong enough for such use, but because of their light weight are suitable for core work in making ply wood.

White Pine

This species is also known as Weymouth pine, Northern pine, spruce pine and soft pine.

White pine, although somewhat softer, less shock resistant, and less stiff than spruce, is comparatively strong and light, uniform in structure, easy to dry and work, and stays in place well. It is a fairly satisfactory substitute for spruce and because of its lightness makes excellent cores for ply wood. Norway (or red) pine may also be used as a spruce substitute.

The remaining supply of virgin white pine is fast disappearing; and, since very little wing beam material can be obtaned from second growth, this species will not long continue to be an important aircraft material except possibly for ply wood. White pines average 3 feet and more in diameter and 100 feet or more in height.

Western White Pine

This species is also known as Idaho white pine, mountain pine and silver pine. Western white pine is slightly heavier than spruce but compares very well with it in all properties except hardness. Because of the relatively small percentage of the cut that is available for aeroplane use, and because of the abundance of other woods suitable for the same purpose, it is very likely that western white pine under normal conditions will not be a very important source of material for the manufacture of aircraft.

Sugar Pine

Sugar pine is low in shock resisting ability and in the quality of stiffness. It varies widely in the strength properties and is therefore not well adapted for parts of aircraft where great strength is a requisite.

Being soft, light, and easy to work, it may be used in less critical parts, particularly for ply wood cores. Since, however, other species cut for wing beams will yield a large supply suitable small sized material, sugar pine may never become very important for aeroplane uses.

Western Hemlock

This species is also known as Prince Albert's fir and Alaska pine.

Western hemlock is low in shock resistance, heavier than spruce, but lighter than Douglas fir. It might be used as a substitute for spruce but it will be useful only to a limited extent so long as supplies of better material are available. It makes a satisfactory ply wood core and may sometimes be of considerable importance for this purpose since the supply is large and the wood comparatively cheap.

Red Wood

Red wood and "Bigtree" are variable in their properties and not suitable as a substitute for spruce. On account of its lightness it is good for ply wood cores. This material is easily worked.

Bald Cypress

This species is also known as cypress, swamp cypress, southern cypress, black cypress, red cypress and white cypress.

Cypress is slightly heavier than spruce. Carefully selected pieces are somewhat superior in strength to spruce when used in the same sizes. It is greatly variable in its strength properties, however, and selection of suitable pieces is difficult on that account. Furthermore, satisfactory methods of drying and gluing have not yet been developed. Until these difficulties are overcome it will probably not be a popular wood for aircraft use.

(To be Continued)

A-E-R-O-N-I-T-I-S

A Family Model

North: "When I saw Charley a year ago he was just about to buy a two-passenger runabout. Did he get it?"

West: "No. He got married and bought a one-passenger pushabout."—*Judge.*

The Luck of Ananias

Sunday school teacher asked a small girl the other day why Ananias was so severely punished. The little one thought a minute, then answered: "Please, teacher, they weren't so used to lying in those days."—*London Post.*

Ethel: "You can't judge a man by the way he dresses."

Mary: "Oh, I don't know. I can tell a gentleman by his get-up in a crowded street car!"—*Judge.*

"How do you like my new dress, Dad?"

"I don't think much of it as a dress. As a hosiery ad, it's fine."

Teacher: "What would you do in the case of someone drowning?"

Student Life-saver: "Bury him, of course."

Inquiry Officer: "Were you ever married?"

Would-be Soldier: "Yes sir."

Inquiry Officer: "Whom?"

Would-be Soldier: "A woman."

Inquiry Officer: "Did you ever hear of anyone marrying a man?" (this sarcastically).

Would-be Soldier: (brightening) "Yes, my sister did."

Just Like a Man

Gladys: "Did your husband take you to the baseball game?"

Mae: "Yes. I wish he'd talk to our cook like he did to the umpire."

Stunt Aviator: "Behold me, in the flower of manhood."

She: "Yes, a blooming idiot."

Mechanic: "My brother takes up Spanish, Greek, French, Italian and German."

Pilot: "Z'at so? Army or school, son?"

Mechanic: "Nope. He runs an elevator."

Shocking

Mary had a little dress,
She wore it very high;
And everybody turned and stared,
When she came passing by.

He: "Does your dad object to kissing?"

She: "I don't know. Did you want to kiss him?"

Mechanic: "Say, Colonel, we mechanics demand shorter hours."

Colonel: "Really, old chap, I can't do a thing about it. Better go to Father Time."

Apologies to Longfellow

I shot an arrow into the air,
It fell to earth I knew not where,
Until one day with rage profound,
The man it fell on came around.
In less time than it takes to tell,
He showed me where that arrow fell
And now, I do not greatly care
To shoot more arrows into the air.

E. A. M. D., Jackson, Michigan.

I

When Homer smote his blooming lyre,
He smote his way to fame;
But many hundred simple souls
Have never heard his name.

II

When Babe Ruth smites the blooming ball,
And smites it o'er the fence,
His "Homer" makes the Grecian one
Resemble thirty cents!

Prof.: "What is the chief state of Mexico?"

Stude.: "Turmoil."

Good Advice

One should say "nay" in a "horse" whisper.

ROAST BEEF OR VEAL CUTLET, SIR.
DELICIOUS SOUP!
HOME SWEET HOME
Z-Z-Z!
PARLOR
BED ROOM
BATH
23
PORTER, WAKE ME UP WHEN WE GET TO VENUS
RICHARDS.

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Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

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The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities —Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

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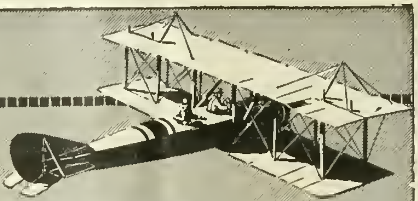

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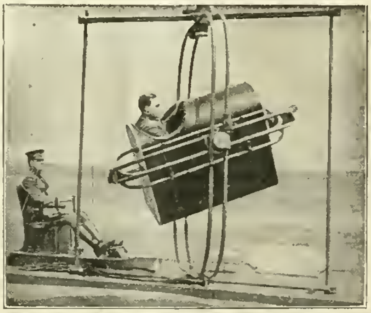

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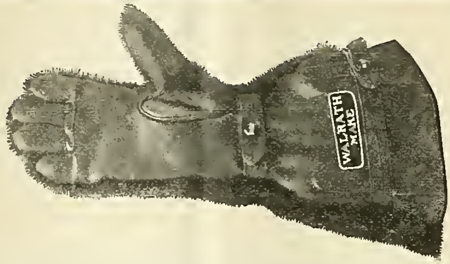

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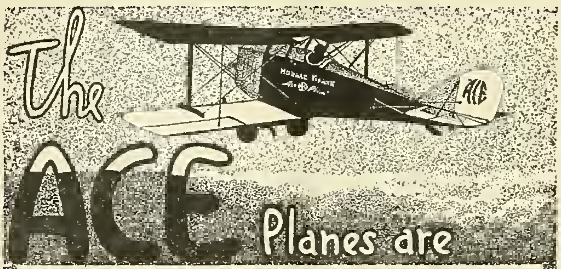

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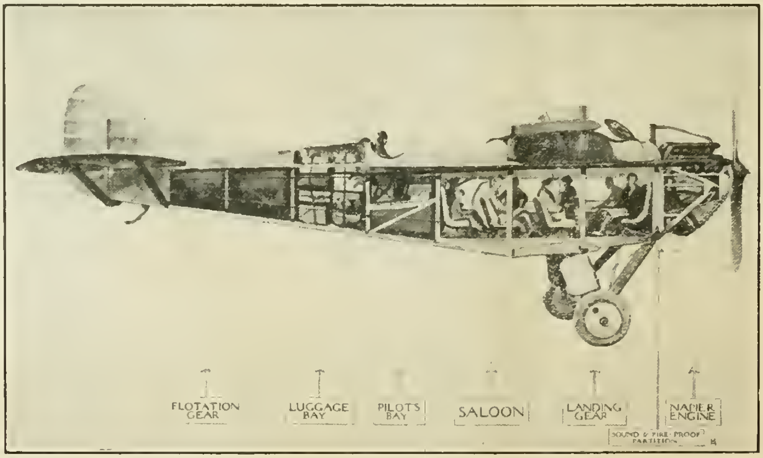

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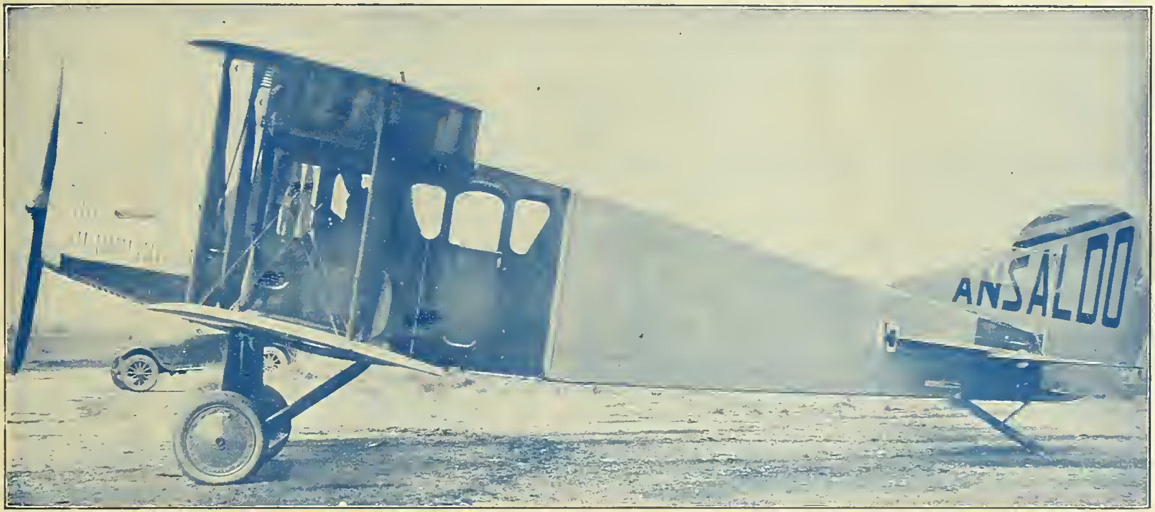

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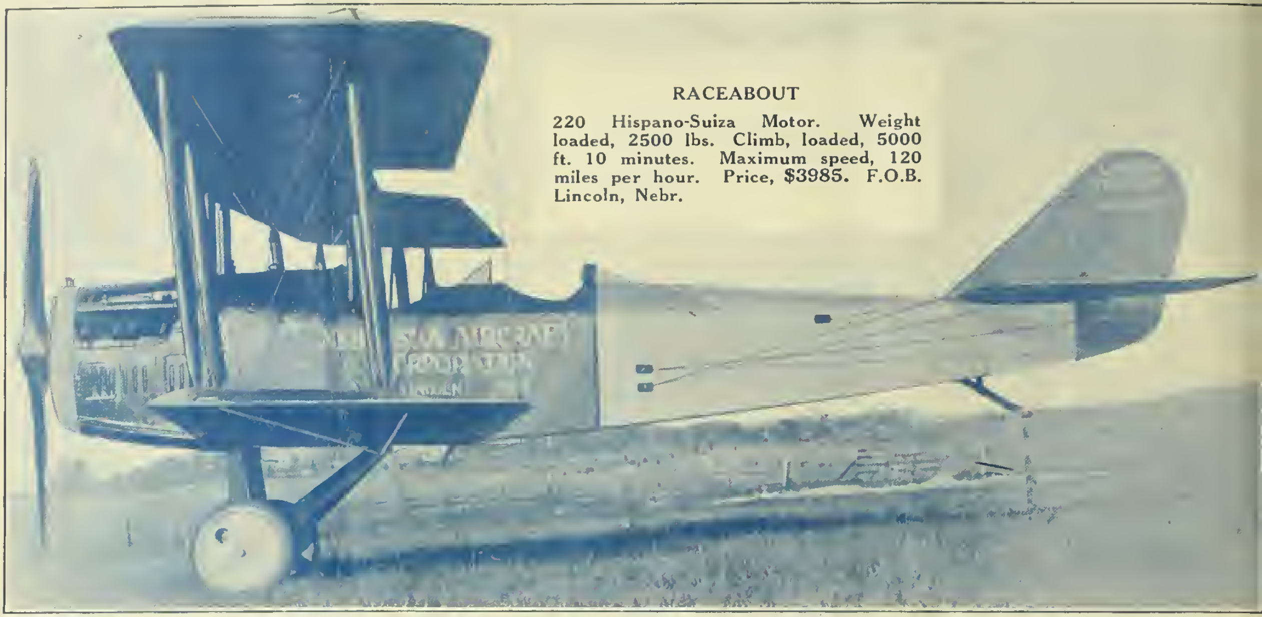

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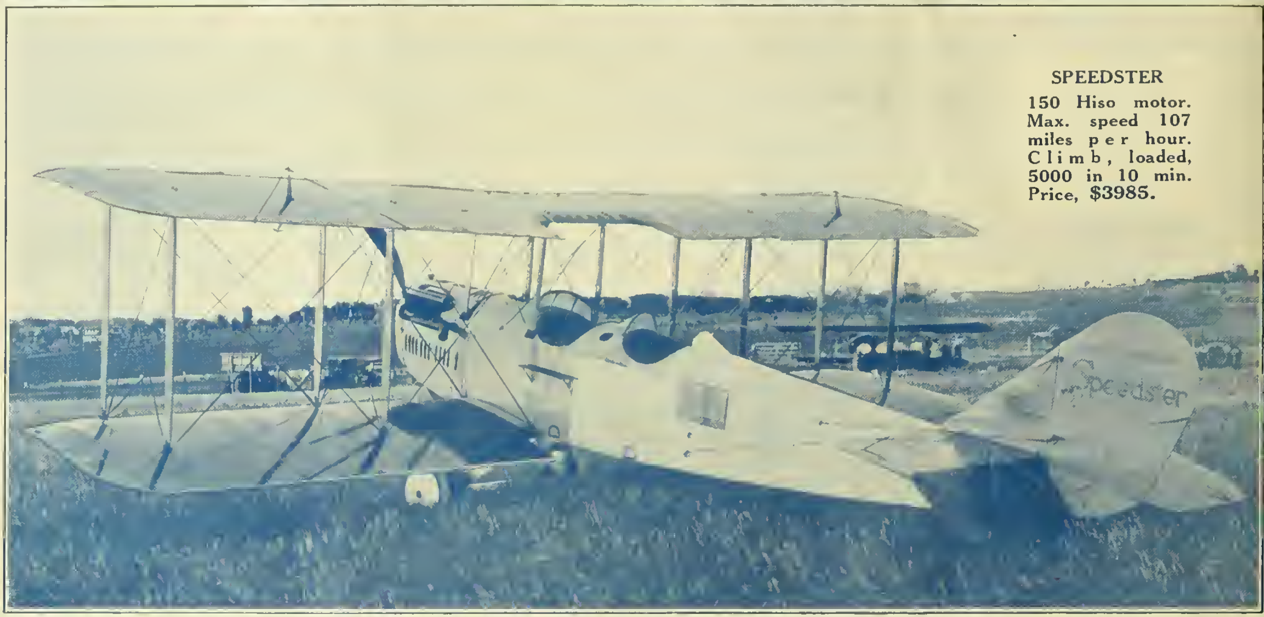

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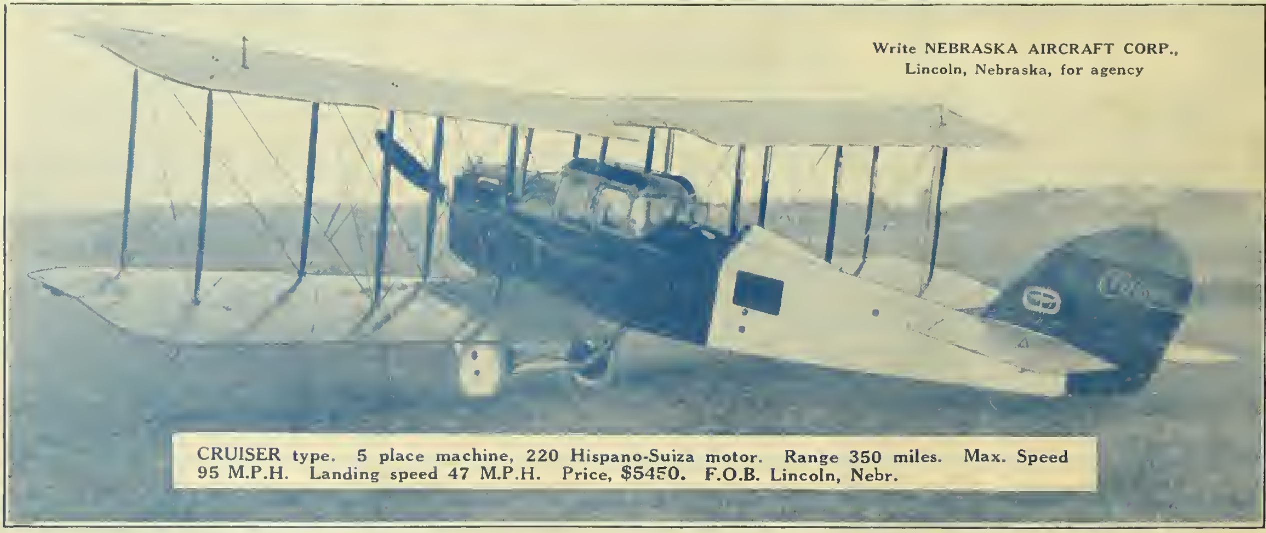

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WEEKLY

VOL 14, No. 4 OCTOBER 3, 1921 10 CENTS A COPY

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German Experimenters and Soaring Flight

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VOL. XIV, No. 4

TABLE OF CONTENTS

German Experimenters and Soaring Flight 75
International Air Laws 75
The News of the Week 76
The Aircraft Trade Review 78
Standardization and Aerodynamics .. 79
Seal Hunting by Air 80
Performance of a Vane-Driven Gear Pump 81
Aero Club of Pennsylvania 84
Naval and Military Aeronautics 85
Foreign News 86
Elementary Aeronautics and Model Notes 87
Aeronitis 88

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German Experimenters and Soaring Flight

THE terms of the Peace Treaty debarred Germany from conducting experiments with full-powered aircraft, and they have filled the gap by conducting trials with gliders with really notable results.

F. Handley Page, the well-known British constructor, recently visited Germany, where he was greatly impressed with this work. He confirms the belief that the German study of this branch of aeronautics is a serious scientific undertaking and points out that the leading German aeronautical scientists, such as Prof. Prandtl of Göttingen, take a deep interest in the tests, and that a number of machines entered have been built under the superintendence of professors of German technical institutes by the students attending those institutes.

The serious nature of the study arises in two directions. In the first place such tests allow of full-scale research being carried on extremely cheap.

The actual gliders, cost little to build—certainly much less than a respectable wind channel, and allow of the making of tests of control, stability and aerodynamic qualities under convincing conditions.

Secondly the soaring tests give opportunities for the investigation of the structure of the atmosphere. This may and should have a direct value for purposes other than that of soaring. Also it is likely to lead comparatively quickly to an understanding of the exact conditions under which soaring is practically possible.

The Wasserkruppe, which is the scene of these trials, is a hill 900 odd metres high (3,000 ft.) in country bare of trees and free of obstructions in all directions. With a wind in any direction, of any appreciable strength, soaring appears to be possible, and up to the present glides of up to 5½ minutes' duration, and of a maximum of nearly five miles in length, have been achieved therefrom. An appreciable element of soaring enters into such flights.

Mr. Page himself witnessed a flight made by Professor Klempferer of the Aachen Technical School in a wind of about 25 m.p.h. The machine used was the Aachen cantilever monoplane. The machine was launched by a crew of about eight men. Two of these held the wing tips, while three were at each end of a long rope passed round the heel of the skids of the machine. This rope had at its end lengths of rubber shock absorbers.

The men at the end of the rope walked forward till the rubbers were fully extended. Then on the pilot's signal the men at the wing tips let go, and those on the rope again walked forward. The machine started to slide over the ground, at the end of two metres was in the air, and within a second was thirty feet up. Moving forward over the ground at a very slow speed, the pilot (Professor Klempferer) proceeded to climb, in a series of steps, corresponding to wind gusts, till he had reached a height of some 100 to 180 feet above starting point.

As the wind at the time was in an unsuitable direction, blowing across from the top of an adjacent peak, the machine soon ran into the down current on the lee of this peak, and descended, landing in the intervening valley.

Mr. Page expresses himself as greatly impressed by the care, ability and ingenuity displayed in the design of some of the gliders, and seems to concur in the German view that they will shortly have learnt enough about the possibilities of soaring flight to build practical auxiliary engined soarers whereon quite extended flights will be possible.

International Air Laws

THE International Law Association has been holding a series of meetings at the Hague recently, for the discussion of various subjects related to intercourse between nations. How far these discussions are of an official nature, or whether the decisions of the Association have any binding effect on the nations represented, we do not altogether know. As a matter of fact, we believe the discussions are altogether academic and are principally interesting as an indication of the way matters affecting international relations are regarded from the standpoint of the legal mind.

Among other things, the Association has apparently been engaged in the discussion of international aerial law, and has come to the conclusion that the Aerial Convention of 1919 should be ratified by the signatories as soon as possible, and that all the other countries of the world should adhere to it and pass laws accordingly at the earliest possible moment.

The News of the Week

Colonel Patrick Nominated as Air Service Chief

Washington.—Col. Mason Mathews Patrick of the Corps of Engineers was nominated September 21 by President Harding to be chief of the air service, with the rank of Major-General.

The nomination of Col. Patrick, who served as chief of American expeditionary air service, did not come as a surprise in army circles, as his name had been mentioned continuously since it became known that Major-Gen. Menoher had asked to be released as head of the air service. In order that Secretary Weeks might have a free hand in reorganizing that branch of the army Brig.-Gen. Mitchell, assistant chief, presented his resignation also, but Mr. Weeks said that he had agreed to withdraw it and remain as assistant chief, at least for the present.

Col. Patrick is a native of West Virginia, and was appointed from that State to the Military Academy in 1882. During the war he was first appointed a Brigadier General of the National Army and served in that rank as Chief Engineer, Service and Supply, American Expeditionary Forces, in charge of the gigantic construction program in the supply zones in France. Later, when difficulty arose with the air program of the expeditionary forces, he was selected by Gen. Pershing as chief of the air service, and in that capacity served during the remainder of the war. On his return to the United States he was assigned to duty as commander of the engineer camp at Camp Humphrey, where he is now on duty.

Secretary Weeks said recently that Col. Patrick's services as chief of the air service in France had been of a very high quality and the War Secretary warmly commended the officer's capacity for organization, even before it was known that Col. Patrick was to be named to succeed Major-Gen, Menoher.

Gen. Menoher, who commanded the forty-second (Rainbow) Division throughout its entire fighting career in France will be given his choice of the three corps area commands that will be vacant in the near future.

Swiss Aeronaut Wins Gordon Bennett Cup

London.—With the landing of the Swiss balloon Sept. 20, piloted by Capt. Paul Armbruster, all the fourteen competitors in the international race for the James Gordon Bennett trophy, which started at Brussels, Belgium had been accounted for. The Swiss entrant landed at Lamby Island, off the east coast of County Dublin, Ireland, and therefore wins the cup.

According to unofficial estimates Ralph Upson, the American pilot in the Belgica I., loaned him at the last moment by Capt. De Muyster and Henry Spencer, an English entry, have apparently tied for second place, their balloons landing close to each other near Carnarvon, Wales. The French balloons Marne and Picardy landed near Dolgelly, in North Wales.

Another Stuntster Killed

Oklahoma City.—Lieutenant Arthur Emerson was killed here Sept. 24 while attempting to change from one aeroplane to another at the State Fair Grounds. Six thousand persons saw him fall 200 feet.

L. C. Brand Makes Unique Trip

Another achievement for the Liberty motor was recorded, when L. C. Brand's Liberty motored Le Pere made a round trip to Mono Lake, Mono County, California from Los Angeles recently. This was the first time any aircraft had ever landed in Mono County.

The field was 7000 feet high, right in the heart of the old Sierras, bordering on Mono Lake. The location is about due east of Yosemite, in that part of the country to which people come from great distances to take part in the yearly trout fishing, which is supposed to be the best in the country.

Mr. Brand is a wealthy aeroplane enthusiast, owning two late type aeroplanes, and who does not believe in keeping them idle. The flight was made from Los Angeles, by way of Mohave and Bishop, Calif., with a landing at Little Lake for fuel. The up trip was made in two hours and fifty-two minutes flying time, and the return trip in three hours flat. When one considers that by automobile it is a day and a half journey, the short jump by aeroplane is the only logical way to get there.

The flight was made without incident, no rough air was encountered, and the Liberty motor never missed a shot. G. G. Budwig, who originally tested the machine for its constructors, was the pilot. Mr. L. C. Brand and F. W. Pomeroy were the passengers, and the old timers at Mono Lake still cannot get over the fact that the party had breakfast in Los Angeles, and lunch at Mono Lake.

District of Columbia Considers Air Traffic Control

District and police officials differed at their meeting September 15, as to the regulation of aeroplane traffic in the District of Columbia, recommended for the first time in the annual report of Superintendent of Police Gessford.

In the absence of Major Gessford, who is now on his vacation, speculation was rife as to the best means of patroling the air. An act of Congress will be necessary to regulate altitude of planes, and examinations of machines and operators.

Assistant Superintendent of Police Charles Evans said some police officials claimed that aeroplanes are included in the traffic regulation providing that drivers of motor vehicles must have permits.

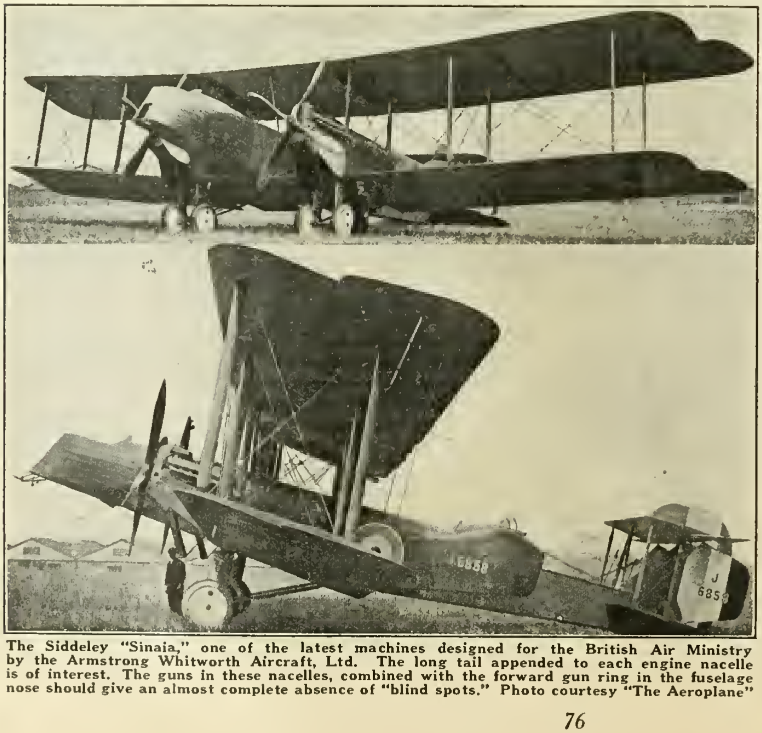
Safety of the machines could be ascertained at the time of application for the driver's permit, and revocation of permits of offending fliers would break up dangerously low flying, it was contended.

Planes should be kept 1,000 feet from the ground, in the belief of some District officials, who cited cases of machines coming within ten yards of Pennsylvania avenue during parades, endangering not only their own but the lives of spectators.

Establishment of an air traffic bureau, with a corps of airmen and plane equipment, would be needed for the enforcement of the law, it was pointed out.

Roosevelt on Air Trip to Address Veterans

Camp Edwards, N. J.—Theodore Roosevelt, Assistant Secretary of the Navy, reached here September 15 by aeroplane from Washington and delivered an address to the State convention of the American Legion of New Jersey. Mr. Roosevelt flew from Washington in three hours in a plane piloted by Lieut. Ford O. Rogers of the Marine Corps and returned in the same machine.



The Siddeley "Sinaia," one of the latest machines designed for the British Air Ministry by the Armstrong Whitworth Aircraft, Ltd. The long tail appended to each engine nacelle is of interest. The guns in these nacelles, combined with the forward gun ring in the fuselage nose should give an almost complete absence of "blind spots." Photo courtesy "The Aeroplane"

Aerial Program at Kansas City Legion Convention

Interest in the American Legion Convention at Kansas City centers in the Flying Club's aerial circus and derby program of eleven events, which is designed not only to entertain the vast crowds, but also to demonstrate the progress of aviation since the close of the war. There will be cash prizes of $10,000 and $10.000 in cups.

On the outskirts of the city, a 90-acre field has been leveled off and arranged for the flying meet. All details are in the hands of men experienced in aviation,—the sixty members of the Flying Club all having served in the army, naval or marine branches of the air service during the World War.

Oil and fuel will be furnished free to contestants. Full facilities will be available for the repair of machines and motors, a complete machine and plane repair shop having been erected on the field.

To date, the entry list includes many of the notable aces and leading civilian flying instructors of the war, in addition to famous pilots now employed by the prominent aeroplane manufacturers and leading stunt and commercial flyers.

Planes of every type have been entered in the meet. From Europe will come several ships made famous in the war. Everything known to the aerial game—the entire gamut from stunts to speed tests—is included in the eleven events on November 1 and 2. The meet will open with a spectacular air raid over Kansas City the night of October 31. Flares dropped from planes playing in the powerful rays of a battery of the largest electric searchlights in the world will characterize the raid.

A feature of the program for November 1 will be a parachute leaping contest for women. The present record of 15,500 feet has been bettered twice recently by two women practicing here for the contest.

Entries for the meet will not be closed until the first event is called by the field marshal. The Flying Club is receiving entries at its offices, 126 Hotel Baltimore, Kansas City.

The list of events and prizes for the flying meet follows:

Event No. 1

(a) Altitude Test. World's Record. Single Seater. $250.00 cup to machine reaching highest altitude.

(b) Altitude Test. World's Record. Two Seaters. $250.00 cup to machine reaching highest altitude.

(c) Parachute Altitude Test. For Men World's Record. $250.00 cup to jumper from highest altitude.

(d) Parachute Altitude Test. For Women World's Record. $250.00 cup to jumper from highest altitude.

Event No. 2

Formation flying by army and civilian planes.

Event No. 3

Parachute drop from captive balloon by a woman.

Event No. 4

Exhibition of plane changing, wing walking and standing on top of wing while plane loops, together with Parachute drop from captive balloon and planes at an altitude of 2,000 feet.

Event No. 5

Stunting contest. Three best planes will be picked for finals to be held on the following day. Absolutely no stunting to be done under an altitude of 1,000 feet. $600.00 Silver Cup for first place.

Event No. 6

Exhibition of Sport Model planes. Planes take off singly, each ship to be in the air seven (7) minutes. They may perform any stunts above 1,000 feet with a view of showing quickness of climb, manoeuvre ability and speed, and finally, landing in the smallest possible distance. Prize $500.00 Silver Cup to winner.

Event No. 7

Relay Race. Entries open only to JN4D's and Canucks, or ships of the same type. Four planes to a team. Entry list limited to five teams. Teams will race from a standing start once around a 15-mile triangular course, 5-miles between corners. Each ship will land back on the field, taxi to the line of start, whereupon the second ship will take off. Prizes to the winning team, $250.00 to each pilot in cash; second place $125.00 to each pilot, total $1500.

Event No. 8

The Legion Junior Derby. Open to all ships of less than 100 miles per hour air speed. The race will be five times around a triangular course of 15 miles; 75 miles in all. Prizes of a large silver cup valued at $1250.00 to be awarded by the President of the United States in addition to cash prizes of $1000.00 for first, $500.00 for second, $200.00 for third, and $100.00 for fourth place.

Event No. 9

Looping Contest for World's Record. No loops under 1,000 feet. $500.00 Silver Cup to the Winner.

Event No. 10

For passenger carrying ships of 5 passengers or more. This is to cover freight, express and mail planes. Planes are to be judged on all-around efficiency. Rules to be designed to develop the efficiency and practicability of the plane as a transportation unit. An efficiency trophy valued at $500.00 will be given the winning ship.

Event No. 11

The Legion Derby. Open to any make of plane, horsepower, or wing spread. Machines to start at scratch, race over a triangular course of 5 miles, 30 laps or 150 miles in all. Prize one leg on a cup costing $2500.00. This must be won twice to become the permanent property of the winner. Another beautiful cup, valued at $1200.00, will be awarded the winner of first place, as his permanent property. These prizes will be presented by the President of the United States on the floor of the Convention Hall. In addition, cash prizes of $3000.00 are offered for first, $2000.00 for second, and $1000.00 for third place.

Colonel Mason M. Patrick, who has been nominated as Chief of the Army Air Service

"Flying Matinees" in England

"Flying Matinees" have always been one of the hardships of the stage business, but now Philip M. Faraday, manager of the Duke of York's Theatre here, promises to put thrills into them with real flying. He will take a company by air to Manchester for a matinee performance at the Hippodrome of "The Wrong Number." After the matinee the company will fly back to London for an evening performance in the Duke of York's Theatre. The distance between London and Manchester is 183 miles. Arrangements for the trip have been completed by the Handley Page company.

Here is the schedule: 8 A. M.—Leave the Duke of York's Theatre. 9 A. M.—Leave Cricklewood airdrome. 11:30 A. M—Arrive Manchester. 12 Noon—luncheon. 1:45 P. M.—Curtain rises. 3:50 P. M.—Performance ends. 4:05 P. M.—Leave Manchester airdrome. 7 P. M.—Arrive London. 7:30 P. M.—Dinner. 8:45 P. M.—Curtain rises at the Duke of York's Theatre.

The company, which numbers fourteen persons, will take their costumes and makeup with them, and returning to London they will have to change from their costumes and remove their makeup while in the air.

World's Board Progresses

The World's Board of Aeronautical Commissioners, Inc., now consists of 98 commissioners in 81 countries and colonies of the world, and when the list is completed, there will be over 125 commissioners in about 100 countries and colonies.

The officers state that in the United States prominent and influential business men are accepting the position of chairman of the board for the state, county and city in which they reside. To date the acceptances indicate that when the organization is completed there will be 48 state chairmen, 2,800 sectional chairmen, 12,000 local chairmen.

The local chairman will have charge of a campaign for members, and if each one secured ten members, it will make the membership in the United States over 100,000.

The above plan carried out throughout the world would make a working staff of 100,000, and should produce 1,000,000 members.

The officers of the organization anticipate that they will be in a position to offer cash prizes to advance aeronautics and encourage the use of aircraft, and that when the people become interested in aeronautics there is every reason to believe the use of aircraft would increase at a wonderful pace as did the automobile following the running of the "Glidden Touring Contests" which interested the people in the automobile, created a great demand for motor cars and did much to cause the building of good roads.

The AIRCRAFT TRADE REVIEW

Lubrication Engineers to Meet

The American Society of Lubrication Engineers will hold its first Annual Convention, in Chicago, on October thirteenth and fourteenth, 1921.

Special effort is being put forward by the officials of the society to assure those who attend a splendid program. A number of eminent authorities will read papers. A number of the largest manufacturing plants and oil refineries have issued invitations to visit and inspect their works.

This society was established to promote a better understanding of the problems of lubrication and the use of liquid fuel oil including all of the problems of application and conservation. As the main endeavor is to interest those whose lives are partly if not wholly coming in contact with these problems, the Convention will be open not only to members of the society, but to all interested in the work.

Something New In Balloon Piloting

An ingenious mechanism constructed by a former Captain of the Air Service, R. C. Pierce, now a Consulting Engineer, at 30 East 42d Street, New York City, is believed to be the first instance in which a "Propaganda Distributing Device" that will automatically pilot free balloons has been developed. The work was done for the Air Service, McCook Field, Dayton, Ohio.

The mechanism is really a combination of two inter-functioning automatic devices, and is intended for the distribution of printed matter, manufacturers' samples and other objects, including the dropping of small bombs, from free balloons. Incorporated in the mechanism is a special provision for arresting the descent of the balloon by the automatic release of sufficient ballast to restore the required degree of buoyancy to maintain practically a fixed elevation.

The first effort of any magnitude to distribute propaganda from the air occurred during the war, when aeroplanes were employed for the purpose; but the losses sustained were so heavy that the attempts were largely abandoned. This led to experiments with spherical balloons, owing to the fact that their path through the air can be forecast with comparative accuracy. The method of distribution was fairly successful but long flights were not possible as balloons without pilots or ballast throwing devices would soon come to earth.

The Pierce Propaganda Device weighs 35 pounds, and is capable of carrying a useful load of 80 pounds. The device is attached to a 300 feet suspension cord close to the balloon, the cord trailing below like a drag line. Attachment to the cord is by friction rollers, which grip the cord and can turn only by rolling down its course. The rate of descent of the device along the cord is controlled by a small centrifugal governor. The device thus furnishes its own power much as in the case of the familiar "monkey on a cord" toy of our childhood days.

Turning with the rollers are shafts, threaded right and left, on which is hung the material to be distributed. If this is printed matter holes are punched at one end of the sheets. Rotation of the shafts causes the paper to feed off the ends and down through slots in the bottom of the waterproof cover of the device. Ordinarily twenty sheets per minute will be fed off in this manner, at which rate eight hours are required to distribute a full load of propaganda and bring the device to the end of the suspension cord.

The automatic pilot consists of a tight case containing what, to all intents and purposes, is a small gas holder. An increase of atmospheric pressure on descending will force the ball downward, closing an electrical circuit, current being furnished by dry cells. This throws in a clutch, causing a ballast shaft, having a coarse right and left hand thread, and carrying printed matter, to rotate one revolution and then stop. In this revolution sufficient ballast is released to check the descent. The electrical contact also opens a magnetic valve and restores the pressure equilibrium within the automatic pilot, and the device is reset for the next attempt of the balloon to descend. The time required to actuate the device is less than one second, and it is sensitive to descents of less than forty feet.

Provision is made to start feeding the propaganda at any desired time after the balloon leaves the ground, and also to destroy the device when all propaganda has been distributed. With this device printed matter may be distributed at little more than postage rates.

New York-Cuba Line Inaugurated

A new bi-monthly aerial transportation service between this city and Havana was inaugurated when the flying boat Presidente Zayes left the airport at Eighty-second Street and North River with four passengers on board. The passengers were Miss Dona Mobley and Miss Gladys Carruthers, of this city, and L. Lopez de Haro and Alegario Monteo, two wealthy sportsmen of Havana.

The new flying boat, which is one of the fleet operated by the Aeromarine Airways, was piloted by D. G. Richardson and Richard Greisinger. It will make two stops during the 1,400-mile flight and will not do any night flying.

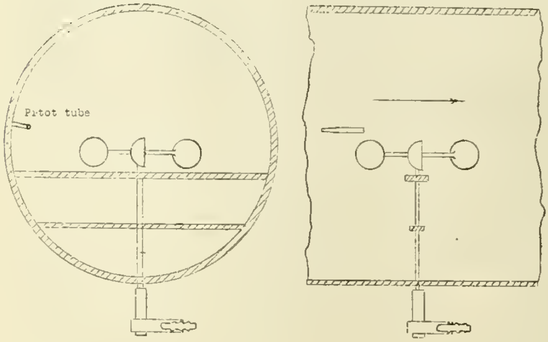


Fig. 9

Performance of a Vane-Driven Gear Pump
(See page 81)

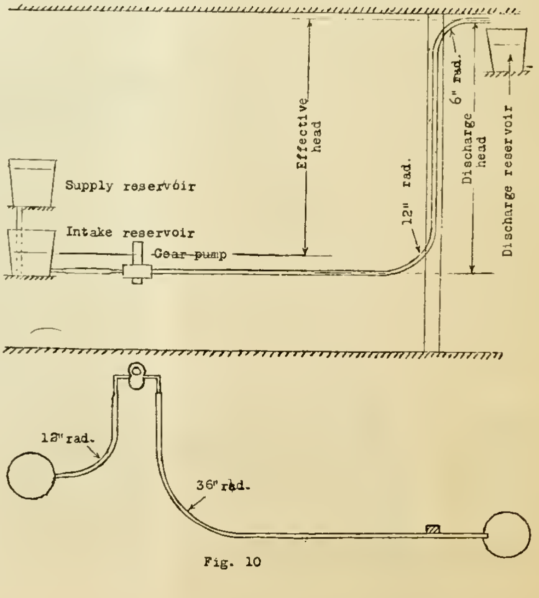


Fig. 10

STANDARDIZATION AND AERODYNAMICS

By PROF. L. PRANDTL

Head of the Aerodynamical Laboratory, Göttingen University
With an Introductory Note by William Knight

Introductory Note

IN the last June 20 issue of the AERIAL AGE I pointed out the desirability of reaching some sort of agreement between the various research aerodynamical laboratories and other scientific aeronautical organizations both in this country and abroad about the symbols, graphical methods and other means of representation used in technical and scientific aeronautical publications giving the results of the research work done by the various investigating aeronautical agencies in the United States and in Europe.

Such work is useful only if the results obtained in the laboratories are presented under such a form as to allow to be readily used by aircraft designers and constructors and by students of aeronautics. At the present time there is such a confusion of symbols, terms and meaning of graphical methods used by the various aeronautical research agencies in the world and such a lack of well organized co-operation among the leading aeronautical laboratories that it is no wonder that aircraft designers, engineers, contractors and students of aerodynamics fail to benefit to the fullest extent of the excellent work which has been done and is being done by the various aerodynamical research laboratories in the United States and in Europe. The results of such a state of affairs are a waste of energy and a consequent retard in the progress of aeronautics.

A remedy to these unfortunate prevailing conditions could be worked out if a leading scientific research organization in this country as, for instance, the Bureau of Standards or the National Advsiory Committee for Aeronautics should take the initiative in suggesting to the various aerodynamical laboratories and other scientific aeronautical research organizations both in the U. S. and in Europe the adoption of the same symbols and the same terms for expressing the same thing everywhere; in other words, applying standardization to aerodynamical works.

An agreement could easily be reached because the importance of reaching an agreement is very badly felt by every student of aerodynamics. All that is needed is to have a leading scientific aeronautical organization posing the problem and to invite a free discussion of the various standards used by the various European nations and by ourselves. From the discussion, which can take place by correspondence, a common ground of agreement can be found and after such an agreement has been reached an international conference between the representatives of the various organizations which have discussed the matter can be called and the adoption of international standards on aerodynamics can be decided upon. Also a function of this international conference should be to devise a means of bringing about a much desired closer co-operation between the various research laboratories so as to present as much as possible the dispersion of good efforts.

The National Advisory Committee for Aeronautics or the Bureau of Standards are the best suited for taking the lead in such a vitally important matter because, fortunately enough, we are free from post-war hatred and we would not be inclined to discriminate between scientists of formerly allied nations and scientists of formerly enemy nations as might probably be the case if the lead in this matter should be taken by some European aeronautical organization under government control.

I know for a fact that American leadership in this matter would be greatly welcomed by everybody in Europe interested in the scientific progress of aeronautics and by making such a step we would greatly contribute to such a progress.

In the meantime, while eagerly waiting for something being done in the direction pointed out above, I have taken up the matter with leading aerodynamical research workers and I have asked them to express their views on the subject of "Standardization and Aerodynamics."

The following paper from Professor L. Prandtl of Göttingen, Germany, who has contributed to a very large extent to the present knowledge of aerodynamics is published with his kind permission. The point of view of other European leading aerodynamical research workers will be published later for the purpose of showing that all of them have useful suggestions to make and that all that is needed to bring about results is to take the lead in bringing them together and letting them decide something which will be agreeable to everybody and especially to manufacturers and designers of aircraft who are the only ones for whom the reseach work is done in the laboratories and books and for whom technical reviews are published.

PROF. PRANDTL'S COMMENT

1. *The Wind Tunnel.*

In order to accomplish any comparative results in wind tunnel tests it is of prime importance to have *the air currents comparable.* This of necessity calls not only for an accurate air current at the place, where the test is to be made in size as well as direction, but that the wind eddies are kept at a minimum. In the Göttingen Laboratory this was one of the main requirements. Fig. 1 shows an easy way to obtain an air current with minimum wind eddies quieted as much as possible in a great profile through a honeycomb and then contracted in a much smaller cross section. The tests are made on the place marked Exp. Fig 1.

I maintain that this arrangement is very important and firmly believe that only this or any equivalent arrangement will give comparative results. It is of less importance, whether the wind tunnel has closed circulation, or whether a tunnel with suction blast is used, and whether the measurements are made in a free air current or between stationary walls. In regard to horizontal bouyancy the free air curernt, as first introduced by Eiffel, is in my opinion to be preferred. Through special formation of the outlet the velocity can be made constant even at a short distance from the mouth of the outlet surface. Through determination of the drag of a big ball the wind eddies of the air current are accurately determined. As known, below a critical velocity the drift coefficient is approximately 0.24, above this critical velocity about 0.10. The critical velocity—the critical $\frac{VL}{V}$ —is that much smaller as the eddy is greater. The Göttingen measurements correspond very much to the Italian measurements, where

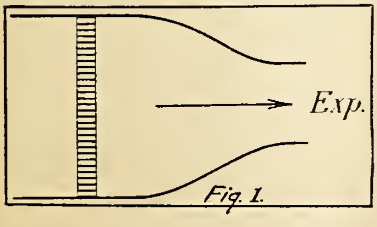


Fig. 1.

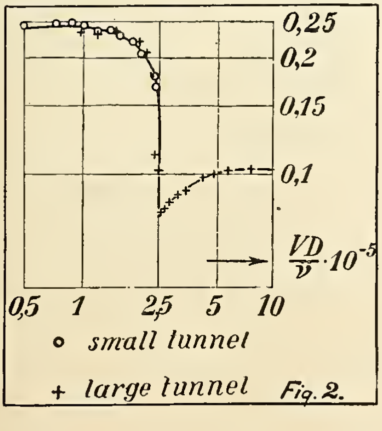


Fig. 2.

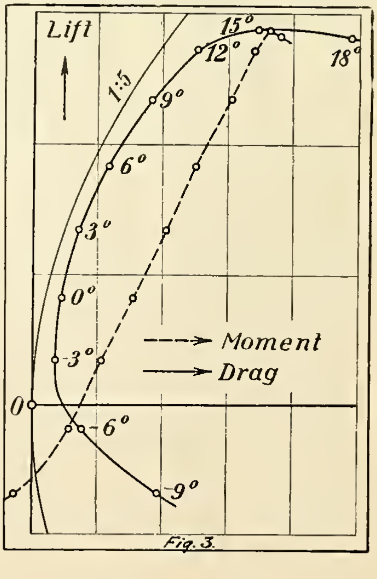


Fig. 3.

a ball was dragged through calm waters. And the conclusion can be drawn that the small wind eddies here in Göttingen do not change the results very much. As example of the agreement between measurements with different wind tunnels, which are constructed on the same principle, I give in Fig. *2* the results of two measurements with balls, one with a ball 28 cm diameter in the great wind tunnel (4 m^2), the other with a ball *20* cm diameter in the small tunnel (1.2 m^2). The almost perfect agreement of both series can be noticed.

2. *Size of models and Air Velocity.*

For approximately correct agreements of model measurements with actual conditions, it is important not to select models and also the air velocities too small for the measurements. In the Göttingen measurements a span of from 1 to 1.2 m. and a wind velocity of 30 M/sec. gave the best results. Even in this ratio the agreement is not perfect, although it is comparatively safe to have the deviations not very great. The modern wind theory allows a calculation of the influences exerted by the walls of the test tunnel or by the limitations of the free air stream. And if this correction is taken into consideration one can safely with the span of the models go even a little beyond half of the air current diameter.

3. *Placing of the Models.*

The manner in which the model is fastened during the test is of greater influence than at first suspected. The difference between the Eiffel results and the N.P.L. results at Teddington is easily accounted for. By the Eiffel tests the wings were fastened with compact screws on the suction side, while by the Teddington tests the models were fastened on the pressure side. As known, any disturbing element on the suction side entails quite a drag which increases with the angle of the incidence while any disturbing influence on the pressure side brings a decidedly lower and with increasing angle of incidence a decreasing drag. Therefore I believe that from this point of view the Göttingen arrangement (6 very thin wires) is the most satisfactory.

4. *Drift coefficients and the results.*

In regard to drift coefficients, we will perhaps in time come to the agreement to give the absolute coefficients, since in the quality as dimensionless quantities they have the same value for each rational measuring method. Then it would be easy to calculate the coefficients adapted to individual countries. More satisfactory perhaps it would be if the engineers would adapt the absolute system in its entirety.

In the absolute system itself there are two different definitions. One, only used in Germany and Austria so far, pertains to drift, to velocity head (dynamic air pressure) $\frac{1}{2} \rho V^2$, i.e the pressure appearing as maximum pressure before an obstruction. In English-speaking countries the drift stands for double this aerodynamic pressure (velocity head), also ρV^2, resulting in the coefficients being half as great as the German coefficients. In favor of the German system let me say, that this quantity $\frac{1}{2} \rho V^2$ is obtained directly by speed measurements with Pilot tubes and the relation of air resistance to the Pitot pressure is especially natural. Then again, the drift coefficients of many objects (level, circular disc, circular cylinder, etc.) are by this method approximately 1.

To demonstrate these test results we have developed here in Germany already complete solid forms, for the testing of wings and aeroplane models, as well as for propellers. For wing tests, the lift coefficient as a rule is taken as starting point. This complies in one way with the results of the wing theory, where the lift presents the given quantity, and in the other way for the technical measuring reason that by usual measurements the lift determination is more accurate than the determination of the angle of incidence, which before was used mostly as an independent changeable, added to this, that the definition of the angle of incidence 0° is often arbitrary. The now usual method of wing measurement is shown in Fig. 3. As introduced by O. Lillienthal, lift and drift are carried at right angles to each other, thereby giving the drift, according to the Eiffel method, as 5 times scale of the lift. The result is the so-called polar curve. Alongside of this the theoretical polar curve is shown, which according to the wing theory would correspond to a wing with equal aspect ratio but without profile resistance. The distance between this theoretical parabola and the measured curve shows the profile resistance, which according to our test results is quite independent of the aspect ratio, and shows to be very satisfactory for judging the quality of the profile. The angle of incidence, in many calculations occupying a very negligible place, is written on the individual points of the polar curve.

To show the position of center of pressure the moment coefficient on the leading edge (absolute coefficient for this moment) is given and indeed as being independent on the lift as the deciding quantity. The moment curve is therefore to be preferred, because it runs almost in a straight line, and makes the interpolation of values between the given values very easy. But by the curve, giving the position of center pressure direct, any interpolation is often very difficult, because the lift curve O is infinite. The position of center pressure can anyway be deduced from the moment curve through a simple construction.

The ratio lift-drift, given in English literature mostly, need according to our method not be shown especially, since it can be obtained by simply drawing a straight line from point O to the respective place on the polar curve.

And this ratio is at that not the deciding factor to determine the quality of an individual profile, because it is dependent quite a lot on the aspect ratio, and because that point, which gives maximum lift-drift in a certain plane, is only determined by the parasite drift of the aeroplane.

The showing of propeller test results have in the last few years been brought down to uniformity as well. Details are given in an article by F. Bendemann and A. Madelung in Technische Berichte Bd. II PP 53, etc. Its main drawing (table 40) approaches the methods of Eiffel and Rith. The absolute torque is taken as function of flying speed ratio to periphery velocity ratio in logarithms and the efficiency is shown in numbers.

It is my desire to have this article lead to a discussion of interested aeronautical experts and further through this discussion the question of standardization in Aerodynamics.

L. Prandtl,
Prof. University Göttingen.

(*translated by J. Vanier*)

SEAL HUNTING BY AIR

In a recent issue of the London *Illustrated News*, Edgar C. Middleton contributes an interesting article on the above subject, which reads as follows:

The story of man's conquest of the air has only just begun, for aviation is continually attacking new worlds. The latest advance has been made in alliance with the squatter, the trapper, and the hunter. Airmen recently have been assisting the hunters along the Grand Banks of Newfoundland in tracking down seals.

It happened in this way. A Newfoundland sealing captain who had returned to his calling from the war had watched the airmen hunting down U-boats among the grey wastes of the North Sea. He became aware of a certain similarity to his own business of sealing. There is something of the seal in a submarine, more than the fact that their habits are similar. The sealing captain put two and two together. An aerial observer who could spot the elongated form of a submarine from a distance of forty miles at 5,000 feet should add many hundreds to the catch when it came to seal-hunting.

His idea materialized, and in March of this year there arrived at the Bay of Exploits, northward from which lie the great sealing grounds, a small party of British airmen. Led by Mr. F. S. Cotton, a young Australian, this party included another and a spare pilot, a couple of mechanics, and two machines, and forthwith they got to work erecting their hangar on the shores of the bay.

Within a few weeks they were flying out hundreds of miles over the ice, cooperating with the ships in the sealing. In all, they coverd 2,000 miles of the ice-fields, or something like 20,000 square miles, in the first expedition, one flight taking them very far from their base. This aerial cooperation assisted in a catch of 110,000 seals.

Belle Isle is the centre of the great seal fisheries. There the seals pass the winter. There the flipperlings—young seals—are born, and from there, as the ice begins to break up with the spring, they and their parents come floating southwards on huge blocks of ice. Every year, regular as clockwork, towards the end of February, the ice-floes start floating couth. Every year, between March 21 and March 25, the entire seal nursery arrives off Fogo, where the sealing fleet waits their arrival.

The actual bagging of the seals is a comparatively simple matter. Immediately they are sighted, the entire ship's company take to the boats, and, clambering on the ice, club the seals over the head, skin them, and haul their skins and fat back to the ships, at the rate of thousands a day.

Like the old proverb, though, you must first catch your seal "before you sell his skin." In these vast seas it is no easy matter to track down even an army of 100,000 seals. From the time that the ice-floes arrive until the seals take to deep water again, far beyond the hunter's reach, is only a matter of a few weeks at most. In that brief spell either the sealers have made their catch, or they return to harbour empty-handed for another twelve months.

Sealing is one of the mainstays of the island. A bad season entails much poverty and hardship, and during the last few years of the war, the sealing business went from bad to worse. Another bad season would have meant bankruptcy for the sealers, and so they called in the wonderful observational powers of the aircraft.

On a clear day, and from a height of 5,000 feet, the airmen had a view over the ice that extended to Belle Island, 150 miles away. At the same altitude it was possible to make out the dog teams on the surface of the ice below with the naked eye. Usually, however, the weather conditions the airmen had to endure were little short of appalling. For the most part the temperature stood at zero or below. Frequently they were forced to bring the machine down on the ice, while a great deal of their time was spent in dodging blizzards—at the first sign turning and racing for the shore at full speed. Had they been overtaken by one they would never have returned to tell the tale.

So in their log-book we find the following typical entries: "Blowing very hard . . . 9 P. M. Blizzard. . . . . Ice two feet deep. . . . . Wind blowing about 90 m.p.h., could see nothing. . . . . March 20th.—Made three attempts to get machine up from the ice. . . . . Forced landing two miles out in the bay . . . . warmed engine up with an oil lamp," etc. This warming up was a frequent occurrence in a climate where boiling water froze stiff as it was poured from a can, and the only way to get it into the radiators was actually to heat the metal parts of the engine.

To return to the log-book. One frequently runs across phrases like "A forced landing two miles out in the bay." Such landings were made on the surface of the ice at a speed of over forty-five miles an hour, the machine not pulling up for a hundred yards. Naturally, mishaps occurred—fortunately, none of them serious. Tail skids would snap, and once the machine became so firmly embedded in a heavy snow-bank on the ice that it took three horses and a dozen men the best part of six hours to drag her free again.

Last sealing season the gales were the worst within living memory of the islanders. The inhabitants took to their huts and did not venture forth again till the fury of the storm had vented itself. All the trains were snowed up for over a month, and the aeroplane was the only means of transport available. In the midst of the sealing work an urgent wire was received from the Postmaster-General of Newfoundland to fly out with a mail-bag to St. Anthony, an outlying island. Despite a heavy snow storm, the bag was delivered, and the plane again returned in safety.

The machine that Mr. Cotton was flying was a "Westland," fitted with a Napier-Lion engine. In this same machine he made his famous flight 320 miles out and home across the ice fields.

That day they carried an experienced sealing captain aboard, and he was able to track down the seals by certain signs on the ice surface. It was encrusted all over with low brunt ridges, or "pancake" ice. The prevailing wind was westerly, and, as neither of these conditions was conducive to a lair for young seals, he came to the conclusion that they had passed below a few hours previously and were now making off eastward for deep water. Shortly after they flew near the sealing fleet itself. They signalled to it by wireless: "Turn about! Sail east! The seals have passed below and are now making for the open sea." The sealers took the hint. Within twenty-four hours their catch totalled 110,000 seals.

Meanwhile, warned by change of wind and gathering clouds that a dreadful blizzard was approaching, the aeroplane turned for home at top speed. Barely had the airmen got the machine within its hangar before the blizzard broke, within a couple of hours piling up many feet of snow against the doors.

Nothing daunted by these adventures, Mr. Cotton is off again in a few weeks' time for Newfoundland. Next sealing they anticipate being at work weeks before the ships go out, and in the meantime are to give the fishermen a hand in spotting cod and take a turn with the whalers, out after seacrows and humpback whalers. An aerial mail service across the bay to Labrador is yet another experiment at which they are going to try their hand during the summer months."

PERFORMANCE OF A VANE-DRIVEN GEAR PUMP

By R. H. HEALD

Bureau of Standards

(Technical Note of the National Advisory Committee for Aeronautics)

THE maintenance of an adequate and uniform supply of fuel for an aeronautical engine during flight is an important consideration in aeroplane design. In order to eliminate the uncertainty involved in feeding directly from the supply tank to the engine, the gasoline is frequently pumped upward to a smaller tank located within the upper wing from which it flows by gravity to the engine carburetor. The pump may be driven either (1) by the engine directly, or (2) by some type of wind wheel or rotor mounted so as to be in the relative air stream during flight. The purpose of this paper is to present the results of a test on a pumping unit of the latter type.

The test was conducted in the high speed wind tunnel at the Bureau of Standards on an Aeromarine Plane & Motor Corporation pump.

The driving unit consists of four hemispherical metal cups, 2¾ inches in diameter, mounted on a spider, the hub of which is threaded to take the connecting shaft of the pump. The unit may be mounted on the aeroplane so as to be either entirely in the air stream (Fig. 9) or partially enclosed in a sheet metal housing (Fig. 8).

The pump is of the gear type, the gears being enclosed in a metal casing cast in two sections. The gears have a 1-inch face and a pitch diameter of ¾ inch. The bore of both the inlet and outlet pipes is ¼ inch. The weight of this unit is 2.3 pounds, and the total weight of the equipment, including both driving and pumping units, is 3 pounds.

Method of Testing

Wind Tunnel Test of Delivery.

Measurements of the quantity of fuel delivered per minute were made at various wind speeds, (1) with the housing in place and (2) with the vanes entirely exposed to the wind stream. Fig. 8 shows the mounting of the apparatus with the housing in place. The mounting with the housing removed is shown in Fig. 9. The wind speeds were determined from Pitot tube measurements, assuming a standard density of .00123 gms/cm^3.

Kerosene having a specific gravity of .817 was used in place of gasoline throughout the test, because of the necessity of mounting the pump in proximity to the switchboard controlling the wind tunnel motor.

The delivery of the pump when equipped with the wind-vane housing (Fig. 8) was measured at the wind speeds of 60, 80, 100 and 120 miles per hour, under the following conditions:

(a) With a constant intake head but with different discharge heads,

(b) With a constant discharge head but with different intake heads,

(c) With a constant intake and discharge head but with a different length of discharge hose,

(d) With a constant head and hose length but with elbow-equipped hose nipples or a tee equipped with hose nipples, attached to the end of the discharge hose.

The delivery of the pump was also determined with the vanes not enclosed for various discharge heads (Fig. 9). The rotational speed of the pump with constant discharge head and hose length, both with and without enclosed vanes, was also measured for different wind speeds.

In all the tests the radii of the hose bends were fixed and the lengths of both the intake and discharge hose were maintained constant, except when determining the effect of the length of hose on the delivery of the pump. The bore of the rubber hose used in this test was ⅜ inch. The hose layout is shown in Fig. 10.

Test of Efficiency of Pump.

The efficiency of the pump was determined by driving it directly with a one-fourth HP., 220 volt, D.C. shunt motor. Measurements were made of the power supplied to the motor when running without load. The pump was then connected to the motor by means of a short extension shaft and the hose arranged so as to give conditions identical with those given in Table 1. As in the wind tunnel test, the amount of oil delivered by the pump was determined by weighing. At the same time, the electrical input to the motor and the rotational speed of the pump were determined.

Head Resistance of the Vanes.

In measuring the head resistance of the vanes, the bearing supporting them was mounted directly on the end of an upright strut of streamline form. The strut extended through the tunnel so that the lower end projected below the tunnel floor and was supported by a knife edge mounted on the floor of the tunnel. A weighing arm carrying knife edge and weighing pan was attached to the lower end of the strut at right angles to it and pointing upstream. Suitable weights for

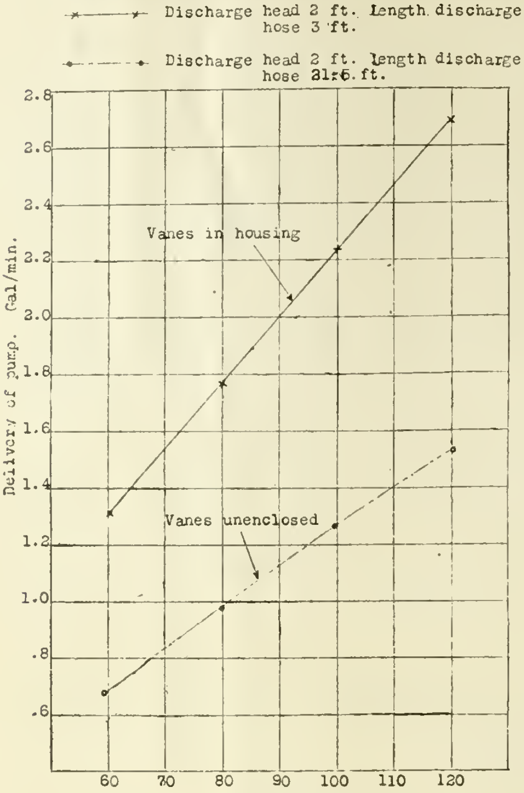


Fig. 1

counterbalancing were also provided. The pump was mounted on the strut outside of the tunnel and was connected to the driving vanes by means of the extension shaft. The hose was arranged for a discharge head of two feet using a three-foot length of hose on the discharge side and a two and one-half foot length on the intake side. The entire set-up was a duplicate of that indicated in Table 2.

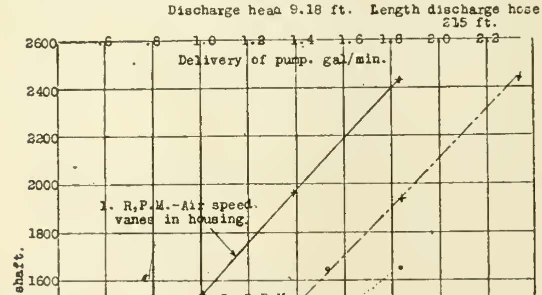


Fig. 2.

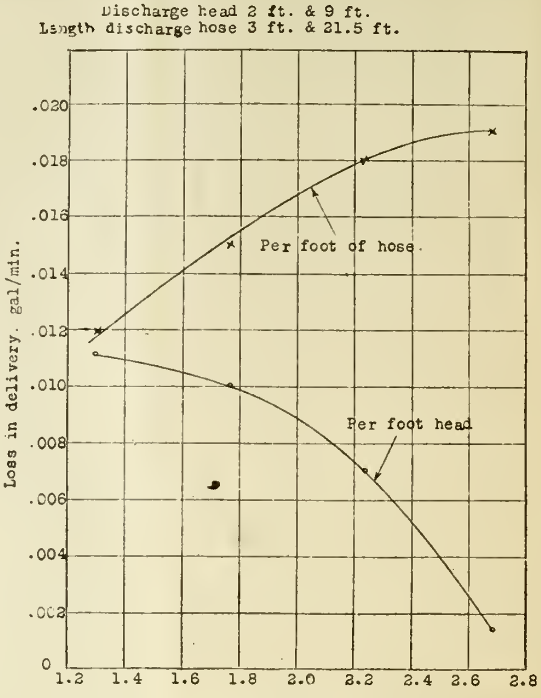


Fig. 3.

In measuring the head resistance of the vanes when enclosed in the housing, it was necessary to modify somewhat the arrangement just described. The housing was placed in the side of the tunnel as for the delivery test (see Fig. 8), and the balance was supported from the floor of the room. Measurements were made of the head resistance of the vanes, with both the enclosed and unenclosed mounting for a range of wind speeds of from 20 to 120 miles per hour. Measurements were also made of the head resistance of a single vane projecting into the tunnel normal to the wind stream.

Performance and Characteristics of the Unit.

Table 1 and Fig. 1 give the delivery of the unit when wind driven, both with the vanes in the housing and with unenclosed vanes. The effect of adding the housing is to increase the delivery at a given wind speed approximately 75 per cent.

Table 1

Discharge head 2.0 ft.
Intake head .22 ft.

Vanes unenclosed. Length discharge hose: 21.5 ft.		Vanes in housing. Length discharge hose: 3.0 ft.	
Air speed m.p.h.	*Delivery gal/min.*	*Air speed m.p.h.*	*Delivery gal/min.*
59.8	.68	60.2	1.31
80.5	.98	80.2	1.77
99.9	1.26	100.0	2.24
120.6	1.53	119.8	2.69

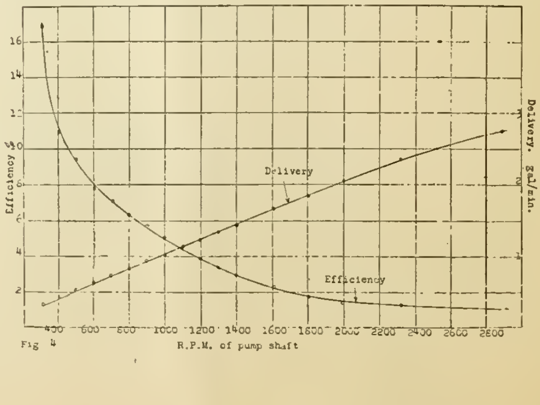


Fig 4

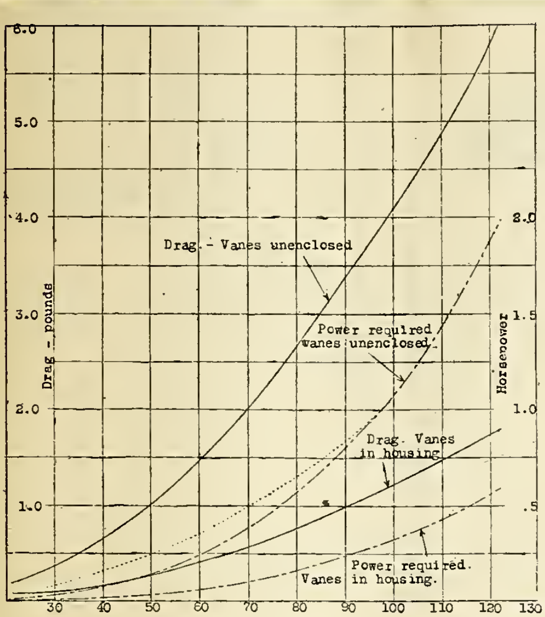


Fig. 5.

The delivery of the unit is proportional to the wind speed. The rotational speed of the pump shaft is also proportional to the wind speed. The inter-relationship of these quantities is shown in Fig. 2.

In Fig. 3 are presented the average results of a series of tests made for the purpose of determining the correction to be applied to the delivery rating for each additional foot of hose or foot of discharge head. The delivery is decreased approximately 1% for each foot of hose added.

The resistance of a tee is equal approximately to that of a foot of hose, and of an elbow to that of 2 ft. of hose.

Assuming the pump delivery to be the same for gasoline as for kerosene and assuming the fuel consumption of the engine to be 0.55 pounds per brake horsepower per hour, the pump with the vanes in the housing would deliver fuel for 1650 b.h.p. at an air speed of 100 miles per hour, with the short connections given in Fig. 1. With the vanes mounted entirely in the air stream, the conditions being the same, the pump would deliver sufficient fuel for 920 b.h.p. at an air speed of 100 m.p.h.

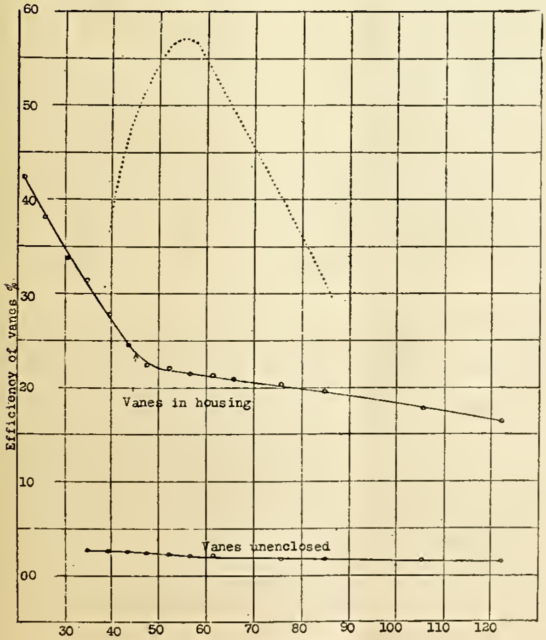


Fig. 6.

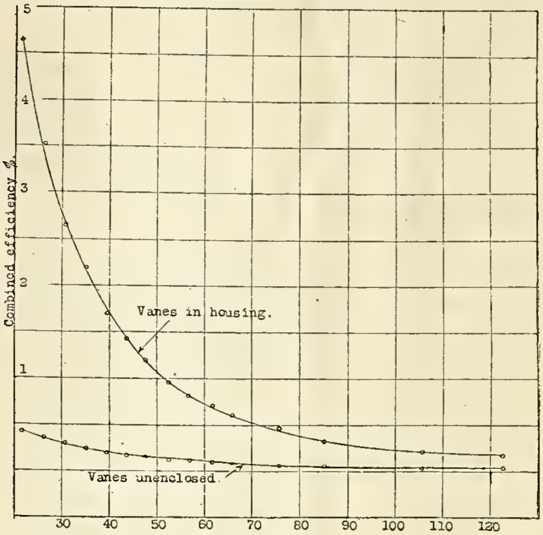


Fig. 7.

Performance of Pump when Motor Driven.

The delivery of the pump is directly proportional to the rotational speed of the shaft up to 2200 r.p.m., but above this speed the coefficient decreases slowly. The efficiency of the pump is low, the maximum efficiency (17%) occurring at the lowest angular speed (310 r.p.m.) at which observations were made. The efficiency decreases rapidly with increase in speed

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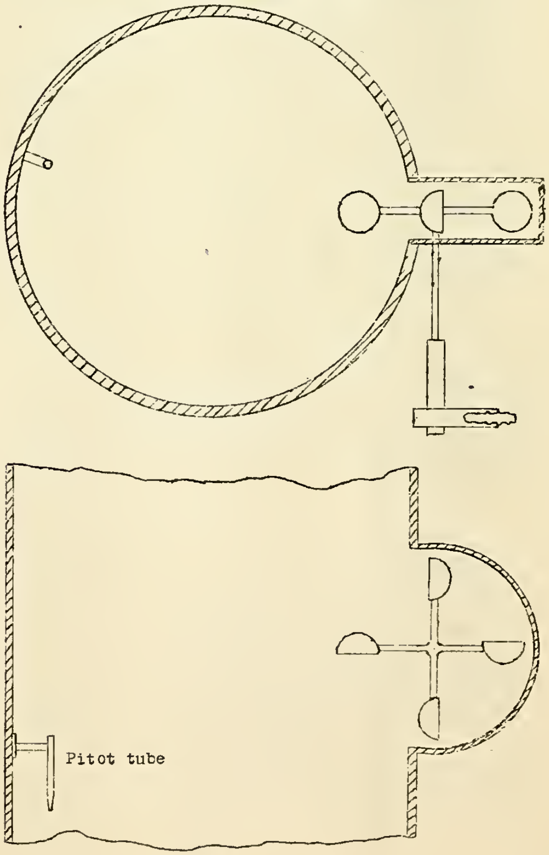


Fig. 8

OFFICERS

Joseph A. Steinmetz, *President*
1421 Chestnut Street
William H. Sheahan, *1st Vice-Pres.*
J. Sidney Owens, *2d Vice-Pres.*
George S. Gassner, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. Bamberger
Charles L. Hower
George S. Ireland
Frank A. L. Leahy
John W. Pratt
D. J. Spence, Jr.
A. Stanley Truscott

An item of news of much interest to the members of the Club is the announcement that a branch of the famous Fokker aeroplane factory, from which came virtually all the best fighting planes used by Germany during the war, is a likelihood for Philadelphia as the result of a recent visit to this city of a representative of Anthony H. G. Fokker, the Hollander who designed and built the planes bearing his name.

H. P. French, who came to the Industrial Bureau of the Philadelphia Chamber of Commerce, a direct representative of the famous aeroplane builder was placed in contact with that organization through Sheridan Taylor, its secretary, with some leading Philadelphia business men who are interested in aviation.

As a result of this conference, Mr. French returned to New York to get in contact with his company in Holland with a view to continuing negotiations looking to the establishment here of a plane plant and also for the starting of a campaign of education to make possible commercial aviation in the line of freight and passenger carrying here and throughout the East.

Mr. French said that Fokker not only was still producing the planes of the type which Germany used during the World War, but also was turning his attention to greater cargo carrying and passenger carrying planes. He also stated that the visit of Mr. Fokker to this country recently, had been responsible for the launching of a big "American plan" for commercial aviation and that plans were progressing so favorably that an American plant soon would be needed. Philadelphia, he said after looking over the ground, was ideally located from the standpoint of materials to be the home of an aeroplane plant.

On September 13th, word was received by several of the officials of the Club that one of the large Fokker planes of the London-Paris type would fly to Philadelphia from the Mineola field, hurried plans for a landing field were made and the large monoplane arrived in Philadelphia early in the afternoon, having been in the air but 75 minutes from the time of its leaving the New York field. Later in the day it left the field of the Aero Service Corporation at 73rd and Elmwood Avenue and with Governor Allen of Kansas returned to New York. The plane which was of the five passenger type had been sent here to carry to New York a copy of the resolutions adopted at the luncheon of the Chamber of Commerce. Bert Acosta, America's most famous test pilot, piloted the plane during the trip to and from Philadelphia.

A seaplane modeled specially for Secretary of the Navy Denby was recently given flight tests at the Philadelphia Navy Yard. Recently completed at the aircraft factory there, the plane was remodeled to give greater comfort and larger passenger accommodations.

The craft is a standard seaplane of the F5L type and was piloted in its tests by Commander Richardson, chief engineer of the aircraft factory and Lieutenant McFall. As soon as fully tested out the plane will be flown to Washington and turned over to the Secretary.

The Coroner's jury at the inquest into the death of Conrad M. Foss, aviator, who was killed with two passengers on August 28th, when his plane went into a nose dive and fell to earth, recommended the appointment of a city commission on flying. The jury which was specially selected by Assistant Coroner Paul was composed of fliers and aviation experts and brought in a verdict that they found no one criminally responsible for the accident.

"We recommend," the verdict read, "that a commission be appointed by the proper city officials to draft the proper rules and regulations to govern flying, including registration of machines, examination of pilots, inspection of flying fields, equipment and protection given the public.

"Unless proper supervision is given passenger-carrying flying we are going to have a repetition of the accident that just happened." Members of the jury conferred with Director Cortelyou as to air regulations, following the inquest. "At present" said Charles L. Hower of the Philadelphia Aero-Service Corporation, with flying fields at Hatboro, "there is insufficient regulation over fliers and flying. I understand a code is being planned by the American Bar Association and certainly a competent commission of flying men and aeronautical experts should be appointed to consider the supervision of aerial navigation."

The jury was selected by the Coroner's office as follows Foreman, Walter Johnson, former aviator and at present a banker; Frank Mills, aviator of the Essington School of Flying; Frazer Kolb, banker and former aviator; Casper Druding, aviator at Hatboro Field; William H. Sheahan, first vice-president of the Aero Club of Pennsylvania, and Lieutenant Charles Vandeveer of the U. S. Air Service.

On August 27th a plane carrying a photographer, swung close to the statue of Penn on the top of the city hall tower, and took several "close ups" of that famous personage. The plane was sent up by the Welfare Federation in charge of Captain Douglas Robertson, U. S. A., from the Clementon field to the field at Elmwood where George Hardy, a camera man for the Stanley Company of America was taken on.

As the machine neared city hall, Captain Robertson dropped down to 500 feet altitude to allow Hardy to get within range of William Penn, whose picture is to be used in the introduction of the Welfare's film, "One Call, One Heart, One Answer" which is to be shown during the Community Roll Call in November.

The stated meeting of the Club was held on evening of September 16th and plans were discussed whereby it is hoped to greatly increase the membership of the organization. The entertainment committee are working out plans for interesting meetings during the Fall and Winter months and lectures of popular subjects in connection with aeronautics will be given by well known aviation experts. Mr. Steinmetz, president of the Club has just returned from abroad after an extended trip in France and England and will no doubt have much to tell the members at the October meeting which will be held in the Club room October 21st, 8 P. M. A full attendance to welcome the return of our president is requested. The usual notice will be sent to all members a few days in advance.

W. H. Sheahan, 1st Vice-President.

4,250-Mile Air Taxi Trip

What is asserted by the De Haviland Company, of London, to be the longest and most successful air taxi trip in the history of flying was completed in Paris, September 15, after 4,250 miles had been covered since the air taxi left its aerodrome on August 25. The company announced the aeroplane was under charter to H. J. Fox, an Englishman. He went aboard the air taxi in the French capital and visited Brussels, Amsterdam, Hamburg, Copenhagen, Stockholm, Christiania, then back to Copenhagen, to Berlin, Warsaw, Prague, Vienna, Venice, Milan, Nimes, Trieste and then to Paris again.

During the long air journey many stops were made, but there was nothing like a serious accident and Mr. Fox was able to go about his business without delays such as would have been caused by stops to make repairs.

When he ordered the air taxi he said he had important business that must be completed rapidly. An air taxi offered the only chance. Mr. Cobham went along as pilot, but did not take a mechanic. He took a few spare parts, however, such as spark plugs and valves, and a hundred different maps for guidance.

The feat, which has been completed successfully, is regarded by the De Haviland Company as without precedent. The company asserts the trip establishes a world record for mileage made by a flying machine in private hire and solo piloting.

Mr. Fox has congratulated the De Haviland Company on the achievement and said he was enabled to do his business in a tenth of the time that would have been consumed in taking trains. Also he said the air trip was infinitely more comfortable than a train trip.

The aeroplane used was a regular DH-9 with a tonneau especially equipped and places for extra fuel and luggage.

NAVAL and MILITARY AERONAUTICS

Bombing the Alabama

Norfolk, Va.—Concentrating their attack upon the abandoned battleship Alabama, army airmen on Sept. 23 demonstrated the effect of auxiliary weapons of modern warfare. A fleet of planes from Langley Field poured a constant fire of chemical bombs on the ship, at times hiding her completely from view in dense clouds of white smoke and flooding her decks with tear gas.

At noon a Martin bomber flew by at seventy-five miles an hour, dropping four 100-pound phosphorus bombs, each of which struck squarely on the vessel. As the "eggs" hit the battleship the phosphorus splashed up and fell to the decks in gray clusters of spray. Flashes of flame glowed through the thick smoke, but were almost instantly obscured by a cloud of dense white fog.

The Alabama was hit on the after fighting top, on the bridge, just aft the forward turret and on the stern. For a long time flames burned the planking on the Alabama's deck, and when the army and navy observers went to view the effect upon the target the fire was still raging.

As no men were stationed on board the Alabama during this or any other test, the personnel of the ship was represented by wooden boxes at various posts. Practically every one of these was scarred and discolored by the phosphorus gas, showing that if the ship had been manned her officers and enlisted men would have been knocked out by the choking chemicals.

The experiments were not to show that a ship can be destroyed by aeroplane fire, but that just as effective a result may be obtained if her system of fire control and her communication systems can be disrupted and the nervous systems of the human beings on board her are shattered.

Besides phosphorus bombs, smoke bombs were used to show that a heavy smoke screen could be so dropped that it would entirely hide oncoming aircraft and also the target itself. There were additional and more elaborate smoke screen tests later.

Still another experiment was conducted with tear-gas bombs. Three direct hits were made with bombs manufactured at Edgewood Arsenal especially for use during the Mingo miners' war.

These contained only a 10 per cent. mixture of tear gas, for they were intended to frighten rather than to injure for a long period. The bombs were so drastic in their effect that forty-five minutes after they struck the vessel observers were unable to penetrate the ship without gas masks.

The assault with the phosphorus bombs won the praise of Air Commodore L. E. O. Charlton, Air Attaché of the British Embassy, who was aboard the mine planter Mills, one of the observation craft. Army airmen applauded as the phosphorus smoke curled above the Alabama. Naval officers reserved judgment.

On September 24 the tests were continued.

A Martin bomber riddled the forward decks of the old battleship Alabama with two 300-pound demolition projectiles. Though only 173 pounds of TNT was used in each bomb, the direct hit on the bow of the ship tore through her first deck, spreading the sides of the jagged hole upward so far that the guns in her forward turret would have been unable to sight above the wreckage.

The crew's quarters below this deck were demolished. A second bomb, dropped with the first, followed through the hole made by the first, causing more destruction.

In addition to the Martin bombers, a fleet of eight swift SE-5 planes dropped thirty-two bombs, many of which struck the ship in vital spots. Her communication systems were shot away, her fighting masts badly damaged and some of her searchlights were put out of commission.

Before the bombing, nine De Haviland-4 planes attempted to lay a smoke screen across the starboard side of the target. Many fell short or did not ignite, but eight caught fire, the white smoke rolling upward in a fan-shaped cloud that hid all the vessel except her prow.

The attacks followed a midnight test, in which planes dropped half a dozen bombs on the Alabama. One struck the ship with such a deafening crash that military and naval observers, asleep on some of the vessels anchored nearby, leaped from their cots in alarm.

This night bombing resulted in several hits, the effects of which could be easily seen when the observers went aboard the Alabama.

Navy Officers Pass Examinations.

Eighty-five per cent of the Reserve Officers of the Pacific Fleet Air Force and from the Naval Air Station passed the recent examination for permanent commissions in the U. S. Navy, according to Capt. Henry C. Mustin, who returned to San Diego from Washington Wednesday. The new assistant chief of the newly created Bureau of Aeronautics added that but 50 per cent of the officers on the Atlantic Coast taking this same examination were able to make a passing mark.

Captain Mustin was full of praise for Rear Admiral William Moffett, the chief of the Bureau, stating that much credit for the successful reorganization is directly due to the Admiral's efforts.

It was also stated by the former commander of the Pacific Fleet Air Force that it would be found necessary to drop a total of 70 officers and 1,100 enlisted men from the Naval air forces within a short time. There will be no curtailment of the activities of the various air units, he said.

Captain H. V. Butler has been selected to fill Captain Mustin's place as commander of the Pacific Fleet Air Force, but Captain Mustin will remain on the coast until November 1. It is anticipated that Commander Towers will be transferred to the East Coast.

Night Flying is Suspended

Night flying has been suspended at the North Island station by order of the commanding officer, and it is not known when it will be resumed.

The newly created bureau of aeronautics at Washingtgon has allowed the station only $9,000 a month to cover all operating expenses, and this is not sufficient to cover the expenses incurred in night flying.

Rockwell Field Resumes

Active flying is to be resumed at Rockwell Field in the near future, according to a recent order from Washington. An observation squadron will be permanently stationed at Rockwell. The squadron will consist of 24 officers and 90 enlisted men, who will be drawn from personnel now at March Field and at Rockwell. Resumption of the Army aeroplane forest patrol service throughout the Ninth corps area of the Army was also announced at Rockwell Field. According to air officials 60 De Haviland planes are now making flights daily over the vast forest reserves in California, Oregon, Washington, Idaho and Montana. The air patrol service has been at a standstill for some time, due to a shortage of funds. The patrol will come to a stop with the advent of the first rains in Oregon and Washington. In California it will cease about October 10.

Maj. H. H. Arnold, air officer of the Ninth corps area, is now on an aeroplane tour of inspection of the Army patrol service. He is making flights over the forest reserves throughout California, Oregon and Washington, inspecting the field stations of the Ninth and 91st aero squadrons.

Maj. Shepler W. FitzGerald, commander of Rockwell Field, left yesterday for a two weeks' vacation at Yellowstone Park. Capt. William Randolf will act as post commander during the absence of Maj. FitzGerald.

Dirigibles May Fly to Alaska

Two of Langley Field's airships, the D-3 and D-4, are scheduled to fly across the continent to California and thence to Nome, Alaska, and return to California.

This will not only be the first attempt at a trans-continental flight in lighter-than-air craft, but also the most comprehensive flying project yet outlined for dirigibles in this country.

Air Service Orders

Ignico, Lt. R. V., to the Cmdg. Off. Langley Field for asignment with airship company.

Bond, Lt. C. F., report to Cmdg. Offr. Langley Field for assignment.

Smythe, Lt. C. E., report in person to the Comdt. Airship School, Langley Field, for duty on the school staff.

Holland, Lt. H. H.; Thomas, Lt. A.; Olmstead, Lt. R. S.; Smith, Lt. J. A., relieved from further training at the airship School, Langley Field; report in person to the Comdt. that school for duty on the school staff.

Biggs, 1st Lt. R. D., to Kelly Field.

Myers, 1st Lt. D. M., to Langley Field.

FOREIGN NEWS

Argentine Record

Pilot Luis Barrufaldi at Palomar field in a 300 h.p. Bristol biplane, with his mechanician as passenger, made the altitude of 7,400 meters in an hour and a half. This is considered the South American record for altitude with a passenger.

Capt. Olivero in a 220 Balilla aeroplane beat the previous South American altitude record by ascending to 8,000 meters in 1 hour and 15 minutes. He first circled over Ituzaingo, Moron, Temperly and El Palomar, gaining altitude, and next over the center of Buenos Aires, the island of Martin Garcia, San Fernando and Lomas de Zamora. Upon reaching 7,500 meters an hour after rising he surpassed the altitude record of Major Hudson of Bolivia. From then on the cold and rarefied air were much more trying to the aviator, who began to lose consciousness, and after reaching 8,000 meters he started to descend, landing in El Tropeson, near San Martin.

Aero Club of Uruguay

The Aero Club of Uruguay was recently founded to work for the benefit of national aviation.

Five hundred meters has been set by official decree as the lowest altitude at which aviators may fly military aviation school aeroplanes for acrobatic performances. To fly lower than this altitude with Government aircraft, written permission must be obtained from the director of aviation.

Sadi Wins Italian Grand Prix

In connection with the Italian Grand Prix for motorcars at Brescia, from September 4 to 11, a "Gran Premio d'Italia d'Aviazione" was flown on September 4, which was won easily by Sadi Lecointe, on a Nieuport-Delage biplane, 300 Hispano-Suiza engine. Thirty-six entries for this race had been received, of which the following started: Stoppani (Ansaldo), Ganzini (Gabardini), Leonardi (Gabardini), Baratini (Spad), Beghetti (Gabardini), Ferrario (Ansaldo), Brack Papa (Fiat), Lordi (Fiat), Sadi Lecointe (Nieuport-Delage), Massi (Spad), Zambelli (Gabardini), and Lovadina (Ansaldo). The course was one of 280 kiloms (174 miles), and was covered in the shortest time by Sadi, whose time was 1 hour 13 minutes 9 seconds, or an average speed of 132 m.p.h. Brack Papa on the Fiat was second, his time being 1 hour 18 minutes 58 seconds.

Entries for Deutsch Cup

The final entries list for the Coupe Deutsch, to be flown at Etampes on October 1, is as follows: (1) Hanriot (Rost), (2) Lumiere de Monge (de Romanet), (3) Nieuport, (4) Sesquiplan Nieuport-Delage, (5) Sesquiplan Nieuport-Delage, (6) Mars I (J. H. James), and (7) Fiat. The pilot of the Fiat is not yet announced, but will probably be Brack Papa, who obtained second place in the Italian Grand Prix. The pilots of the Nieuports will be Lannes, Kirch and Lecointe, although it has not yet been announced who will pilot which. It appears probable that Lannes will fly the older type (No. 3), while Kirch and Lecointe each take one of the new one-and-a-half planes (Sesquiplan). It is extremely gratifying to see the Mars I entered for this country, and knowing the machine and pilot we have no hesitation in saying that we feel sure the French pilots will have all their work cut out. It is one thing to establish speed records over a kilometer, with the human element entering into the timing with stop-watch, but quite another to fly in the same race, and we personally have every hope for the British entrant with his 450 h.p. Napier Lion engine.

The International Michelin Cup

Poirée on a Caudron biplane succeeded in putting up a good performance for the Coupe Michelin. It is scarcely correct to say that he has won it, as there is still time for some other competitor to improve on Poirée's performance. The rules of the competition stipulate that the circuit of France shall be covered in 15 stages, with compulsory landings at each of the following aerodromes: Versailles (any one of the various aerodromes situated in the Versailles district), Amiens, Mourmelon-le-Grand, Saint-Dizier, Dijon, Joigny, Beaune, Bron (Lyon), Nimes, Pau, Merignac (Bordeaux), Romorantin, Angers, Evreux, St.-Inglevert (Calais), Versailles. Competitors are allowed to start from either one of these aerodromes, and apparently the only stipulation is that a "commercial" speed of at least 75 kilometers per hour shall be maintained. Intermediate landings are permitted. The full rules of the competition appeared in "Flight" on February 17.

The last holder of the cup was Eugene Gilbert, who covered the circuit of France (3,000 kilometers) in 39 hours, 35 minutes 42 seconds in 1914 (June 8-9) on a Morane-Saulnier monoplane, 80 h.p. le Rhône engine. The turning points of that circuit were somewhat different, although the total distance remains the same. The war prevented the competition for the next few years, and post-war conditions have been responsible for the non-holding of it until this year.

The first man to make the attempt was Bossoutrot, the famous Farman pilot. His machine was a "Farman Sport," a small biplane with 45 h.p. Anzani engine. Starting from the Lyon aerodrome at Bron shortly before 5.30 a.m. on Friday, August 19, Bossoutrot landed at Nimes about 8 a.m. and, after filling up, proceeded to Pau, where he arrived at 12.25, leaving again some ten minutes later. Scarcely had he got away, however, before he had to make a forced landing, during which he damaged his undercarriage. The reason for the forced landing is given as engine trouble caused by the poor quality of the petrol with which he was supplied at Nimes. Bossoutrot had to abandon the attempt.

The second competitor to make an attempt was Bajac, who was flying a Spad-Herbemont, 80 h.p. Rhône engine. He started from Buc (one of the aerodromes in the Versailles district) at 5.51 on August 28, and proceeded toward Amiens, his first landing point. He was heard circling about, but owing to fog he was unable to locate the aerodrome, and finally, after circling round several times, had to return to Buc, where he landed about 8 o'clock.

The next day he made a fresh start at 5 hours 28 minutes 52 seconds. He arrived safely at Amiens and proceeded toward Mourmelon, where he alighted at 7.40. Leaving again five minutes later, he made his prescribed landings at Saint-Dizier and Dijon, arriving at Joigny at 10.05. After "signing the book" he left again at 10.15 for Beaune, where he landed according to the rules, proceeding toward Bron, where he landed about 2 o'clock. After filling up he got away from Bron at 2.50 and landed at Nimes at 4.36. Getting away again at 4.48, he headed for Pau, where he landed just before dark Getting away early the next morning, he proceeded toward Merignac (Bordeaux), but engine trouble forced him to land at Tarhes, and he gave up the attempt.

The third attempt was made by Poirée on a type 60 Caudron biplane, 130 h.p. Clerget engine. This machine, a *fuselage* biplane, similar in a general way to that used by Poirée in the Monaco speed contest. Leaving Villacoublay (one of the "Versailles" aerodromes) at 4 hours 49 minutes 22 seconds on the morning of August 29, he touched at Amiens and landed at Mourmelon at 7.10. After filling up he left at 7,50, Saint-Dizier and Dijon were passed, and at 10.05 he landed at Joigny, at the same time as Bajac. Leaving again at 10.15, both pilots proceeded together, but the superior speed of the Caudron with its 130 h.p. engine soon left Bajac behind, and a landing was made at 1 o'clock at Bron. Here a stop of one hour was made for lunch and replenishments, and at 2 Poirée got away for Nimes, where he landed at 3.58. Getting away again at 4.22, he headed for Pau, which was reached at 8.00. After spending the night at Pau, Poirée left at dawn on August 30 and arrived at Merignac (Bordeaux) at 7.08, leaving again at 7.12. Romorantin was reached at 11.05 and left again at 11.10. By midday Angers was reached, and getting away from there at 12.45, Poirée landed at Evreux at 2.30. Leaving at 2.35, he landed at St. Inglevert (five miles S.S.E. of Calais) at 4.25 and got away again at 4.30, arriving at the home aerodrome at Villacoublay at 6 hours 03 minutes and 02 seconds, having completed the 1,860 miles in 37 hours 14 minutes 40 seconds, or at an average speed of just under 50 m.p h. This figure includes, of course, the time spent at aerodromes and the stop overnight at Pau. In other words, it is elapsed time and not flying time. Thus for the time being, at any rate, Poirée is the holder of the cup. It is, however, more than likely that other competitors will make the attempt before the end of the year and, by a better performance, become temporary holders of the cup.

The Voyage of the "Quest"

It is possible that the voyage of the "Quest," under Sir Ernest Shackleton, may lead to a substantial addition to the sum of knowledge of the conditions obtaining in the upper air. Sir Ernest recently offered his services to the British Air Ministry to carry out meteorological observations and to gather topographical information during his forthcoming expedition to the Atlantic, Southern and Indian Oceans. The "Quest" has been furnished with instruments and equipment necessary for carrying out observations, and she has been constituted an official reporting ship to the Meteorological Office. She has also been supplied with photographic apparatus and with kites similar to those employed in the investigation of the upper air over the Atlantic during the voyage of the s.s. "Montcalm" prior to the flight of "R-34" in 1919. It is further proposed to take records of the temperature and pressure of the upper air by using a seaplane which is to accompany the expedition. As the ship will, among other places, visit the islands of St. Paul's Rocks and Tristan d'Acunha, in the Southern Atlantic, some valuable data should be collected. The first of these groups lies on the route which would probably be followed by aircraft flying via a position almost midway between South America and South Africa

Airplanes to Carry Gowns to London

Following the example set by *The New York Herald of Paris*, copies of which are brought to London by aeroplane every day and sold in the streets in the early afternoon, the Galleries Lafayette, a well known French department store, which is opening its London branch has announced that not a single frock for its opening was completed before the middle of this week, and some of them will not be finished until the day of the opening, when they will be loaded on special aeroplanes and rushed to London for the opening.

Sport Farman Wins

The Sport Farman, piloted by Bossoutrot, won the International Contest for touring aeroplanes at Brussels on September 3rd and 4th.

The Late Bernard de Romanet

Captain Bernard de Romanet, the noted French aviator, holder of the world's speed record for one kilometer, was instantly killed at Etamps, France, on September 23 while taking part in the elimination races for the Deutsch de la Meurthe Cup.

The canvas on Romanet's machine tore while he was flying more than 100 miles an hour at a height of 650 feet, and the plane fell. The machine was a biplane, from which the lower plane had been removed for the sake of speed.

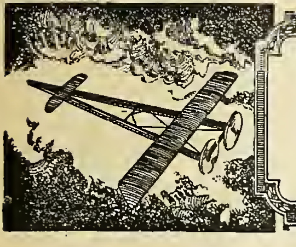
Captain de Romanet's world record for speed was established on November 4 last, when at the Buo Airdrome, near Paris, he flew over a measured kilometer at the rate of 309 kilometers, twelve meters an hour (about 193 miles), covering the distance in 11 65-100 seconds. He was a competitor in the James Gordon Bennett Cup race in France last September, which was won by Sadi Lecointe, and in the following month established a new world's record for one kilometer, in 12.3 seconds. His record was eclipsed by Lecointe the following day with a flight in 12.1 seconds, but this was in turn shattered by de Romanet in his notable dash of November 4.

London-Paris Air Mail Twice Daily

The British Postmaster-General announces that, in extension of the facilities already provided for the acceptance at certain Post Offices of parcels for transmission to Paris by aeroplanes of the Instone Line, arrangements have been made for a second dispatch .of air postal parcels on and from September 1, and until further notice, by Messrs. Handley Page's daily aeroplane service to Paris, leaving Croydon aerodrome at 12.30 p. m. The new dispatch will enable air parcels for Paris to be posted at certain Post Offices in London on the morning of dispatch.

The new dispatch will also enable air parcels to be posted at certain provincial towns up till a later-hour over night than is at present possible, if connection is to be made with the existing dispatch.

Delivery should normally be affected in Paris on the day of dispatch from London by either service.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

What A Model Club Can Do

By W. H. DeLancey, Illinois M. A. C.

MODEL flying requires a lot of hard work and patience which seems to be a combination which few boys possess. Yet in spite of this fact The Illinois Model Aero Club can truthfully say that as it approaches its tenth anniversary it is a stronger and sounder organization than ever before in its history. Its activities of the past six weeks are typical of what it has accomplished in the past and what any club can do if it wants to get out and work.

On July 10, a hydro contest was held at Lake Calumet and Mr. B. Pond seemingly unsatisfied with the old hydro record of 118 seconds, broke it first by a 133 seconds flight and then by a remarkable flight of 172 seconds. This makes Mr. Pond the holder of two world's records for he broke the hand launched tractor distance record last September by a flight of 2,465 feet. (Incidentally on September 5, Mr. Pond raised the R. O. G. duration record to 184.8 seconds.)

At the regular business meeting of July 14, Mr. Lucus, who is one of the "reasons" for The Illinois Model Aero Club being the foremost organization of its kind in the world, reported after weeks of work that the club had been donated a space in the Pageant of Progress exposition by the city of Chicago. Plans were immediately laid for a booth and when the opening guns of the Pageant were fired two weeks later, The Illinois Model Aero Club had probably the best booth ever presented by a model club.

For two weeks nearly fifty thousand people each day stopped to look at these models and nearly a hundred boys paid their dues to join the thinned but sturdy ranks of the I. M. A. C. Almost continuously, slow flying tractor models were kept drifting about in front of the club's booth and thousands of people saw for the first time "one of those things that would really fly."

During the Pageant of Progress an indoor contest was arranged to take place in the large auditorium on the Municipal Pier. This turned out to be by far the most successful indoor contest ever held by The Illinois Model Aero Club. Mr. Pond repeated his performance of four weeks previous, and moved the indoor record up from 130 to 170 seconds. Mr. R. Jaros also went over the previous record and other flights were consistently over the 100 seconds mark. Mr. Pond won a beautiful pair of tubular racing skates donated by the Alfred Johnson Skate Company and Mr. Jaros won a handsome wrist watch donated by Mr. J. Fitzgerald, general manager of that company. Mr. Pond flew a twenty inch model weighing .19 (nineteen one-hundredths) of an ounce. The club is to receive also, as a result of the Pageant of Progress, a beautiful silver loving cup probably to be given for one year to the winner of the annual scale model contest.

The first meeting after the exhibition was another triumph for the club. In spite of a bad storm, over seventy-five members were there and heard the best speakers it has ever been the lot of the club to have present.

The meet of July 21 saw the best flying in several years. Mr. R. Jaros won with an average of 148 seconds. Mr. Pease's model (which held the record back in 1918) came to the front again when it made a flight in this contest of 179 seconds, so far the high mark of the year.

The Illinois Model Aero Club wants to help other clubs, to promote model flying, to help the United States lead the world in aviation. If there is any way in which model flyers of this or any other country can be helped, the I. M. A. C. expresses its willingness to extend its fullest cooperation and invites correspondence from any club or individual interested.

Prize Model Aeroplane Contests Held in New Jersey

In a series of model aeroplane contests held at Camp Edwards during the summer months, which closed recently, the winners were: Samuel Kleinfield, sixteen and Herbert and John Enstice, fourteen and thirteen, of Kearny, N. J.

The contests, free to boys and girls, were held under the direction of Charles Weslow of East Orange, who also is interested in a model yacht racing among New York and New Jersey school boys. Only one girl, Ruth Meiser, fourteen, of Allenhurst, competed. She won a contest.

Herman Pulle, fifteen, of Jersey City, was the winner of the first contest. Governor Edwards, who happened to be passing at the time, complimented the winner. The Governor's grandsons were prominent in the eighth contest, the younger grandson carrying off the honors for a "fancy spiral dive." Some of the contestants had their own models while others used those loaned by the director.

One of the interesting events of the contest was an eleven loop-the-loop stunt by Allen Price of New York, in a model built by himself. One of the prizes offered was a high aeroplane ride in a passenger carrying plane piloted by Captain Paul Micelli, a former aviation officer. Philip Thurr, fourteen, of Sea Girt, won this award.

Mr. Weslow now holds contests on Sunday afternoons on the aviation field at Linden.

Woods Used in Aircraft Construction

(Continued from last week's Issue)

Ash

The varieties of ash are white ash, Biltmore ash, green ash, pumpkin ash, Oregon ash, black ash, and blue ash. There are about ten other species of ash, none of which, however, are of commercial importance.

The ashes known commercially as "white ash" include both white ash and green ash as well as the Biltmore and blue ashes. All of these are very desirable woods for use in aircraft. It is used extensively for longerons, bent work on wings and fuselage, landing gear and other parts of the framework of aircraft and has been used to some extent for propellers. Black ash is not so stiff as the others but is good for bending as it is quite tough. Pumpkin ash is lighter and weaker than the other ashes and therefore is not desirable for aeroplane construction.—(From National Advisory Committee Report.)

Basswood

This species is also called linden, linn and whitewood.

Basswood is light in weight but its strength is low. It is one of the best woods in ability to take nails without splitting and is excellent for webs of wing ribs and for ply wood cores generally. It is also used for thin flooring plank.

Beech

Having strength properties very similar to those of birch and maple, it makes a fairly satisfactory propeller wood where requirements are not too exacting, and was used for this purpose in Europe to some extent. It is also a satisfactory material for ply wood.

Birch

Sweet birch is also known as black birch, cherry birch and mahogany birch. Yellow birch is also known as silver birch, swamp birch and gray birch.

Birch of these two species is quite heavy, hard, stiff, and resistant to wear, of uniform texture, and takes a fine finish. It makes satisfactory propellers and has been used for that purpose in several countries.

Birch ply wood is widely used in aircraft manufacture. Because of its resistance to wear, its stiffness, and ease of bending, it is especially good for face ply, where thinness is essential.

Black Cherry

Cherry wood is a strong, fairly hard, straight grained, works well, and takes a fine finish. It is an excellent propeller wood and is also good for ply wood facing.

Elm

There are five principal species of elm used in aircraft. Cork elm, known as rock elm, cork-bark elm and hickory elm. White elm, known as American elm, water elm and gray elm. Slippery elm, known as red elm and rock elm. Wing elm, known as wahoo, witch elm, cork elm, small-leaved elm, red elm, water elm and mountain elm. Cedar elm, known as red elm and basket elm.

Elm is slightly heavier than ash and rather low in stiffness, but very tough and shock resistant. It steam-bends very well and may be substituted for ash in longerons and for similar uses. It is also used for other bent work such as landing skids and the keels of flying boats. Cork elm has been approved for propellers. White elm is used for bent ply wood.

All of the elms require care in drying because of their tendency to warp and to twist.

(To be continued)

A Few Movie Films

"The Monkey." A gripping tail.
"Secrets of Surgery." At cut rates!
"The Human Heart." This beats them all!
"Limburger Cheese." It turns them away!
"Eyes, Nose and Mouth." A feature film!
"Wedded and Parted." In two parts!
"The Optician's Sign." A gigantic spectacle!
"The Sledgehammer." A smashing success!
"The Divorce Decree." Worth double the price!
"Mammon." The greatest love story ever told!
"Waists and Skirts," and other short subjects!
"Amsterdam, Volendam and Rotterdam." Passed by the Board of Censorship—very reluctantly.
"The Garden of Eden." Come early and avoid the rush!

—*Cartoons Magazine.*

Cave Country Politics

Mr. Skinpants: "I s'pose you know I'm a candidate for county assessor? I reckon you won't turn your back on an old pal like me, huh?"

Mr. Multiskins: "You bet I'll never turn my back on an old pal like you. You'd be likely to jab a spear in it."—*Judge.*

Tour Interrupted

"I'm not a common tramp, your honor," said the tattered individual who was charged with vagrancy.

"What are you, then?"

"I'm a tourist. I started out to see America."

"Your tour will be interrupted for six months. Next case."

—*Birmingham Age-Herald.*

"TRAMPING AIN'T WOT IT USETER WAS—THANK GOODNESS!"

Passing the Buck

Kindly Old Lady: "You are a very nice little boy to give your candy to your little friend."

Youthful Hard Guy: "Aw, he ain't no friend of mine."

"Then why did you give him the candy?"

"The flies was botherin' me."—*Youngstown Telegram.*

The Altruist

Sceptic: "If you have such an infallible remedy for baldness, why don't you use it?"

Subtle Barber (very bald): "Ah, sir, I sacrifice my appearance to bring 'ome to clients the 'orror of 'airlessness."—*Punch.*

First Pilot: "Where's your passenger you took up?"

Second Pilot: (innocently) "How should I know?"

He: "Do you think a girl should learn to love before twenty-one?"

She: "No! That is an entirely too large an audience."

Jack: "Here comes a plucky girl."

Jim: "How da ya know?"

Jack: "Look at her eye-brows."

Nemo: "Did you meet a man with one leg by the name of Saunders?"

Cockney Bill: "H'i sye, wot's the nyme o' 'is other leg?"

Colonel: "That 'bird' over there just asked to be made a pilot. Is he steady?"

Pilot: "That's my mechanic. Sure, if he was any steadier he'd be motionless."

Teacher: "Translate 'rex fugit'."

Stude: "The king flees."

Teacher: "You should use 'has' in translating the perfect tense."

Stude: "The king has fleas."

Capt.: "Is the young lady you visit popular?"

Lieut.: "I should say so! Why she even has to have a chaperone when she accompanies me on the piano."

Observations

Did you ever notice how long and full the skirts were a few years ago?

Well, nowadays I guess the modern girl seems to be saving on the goods to show how conservative she is and how extravagant grandmother was.

Then too, she may want to show her fattened calves. (I beg your pocketbook).

Just to show how clean she is, I'll explain. Long skirts pick up germs and she doesn't like it a'tall!

So the Air Service is of some use. A germ would have to be an aviator to get on *her* skirt now, eh, what, Rollo?

—*Edna McDonald.*

Superfluous

"I have here a book entitled, 'The Successful Chicken Raiser,'" began the agent.

"I don't need it," broke in Uncle Cy Hopkins. "All my children are boys."—*Exchange.*

Polite Hint

Customer—"I say, do you ever play anything by request?"

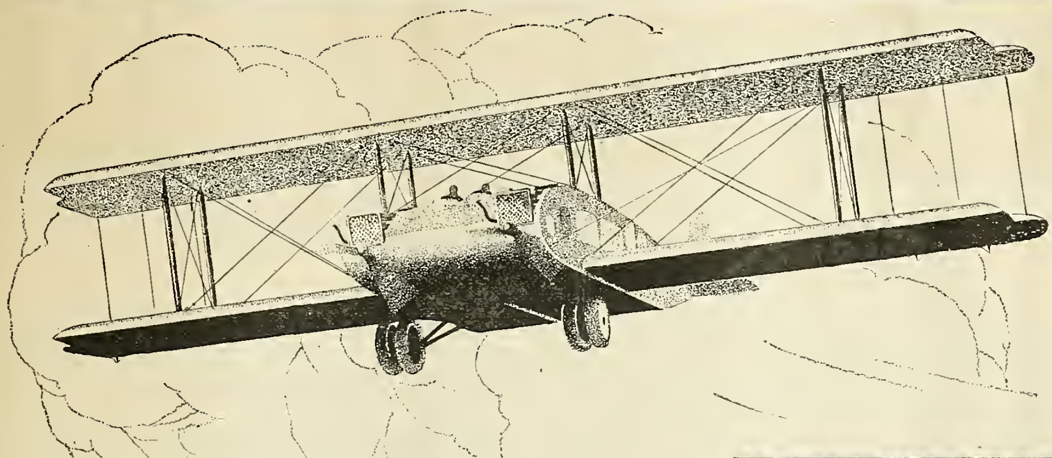
Delighted Musician—"Certainly, sir."

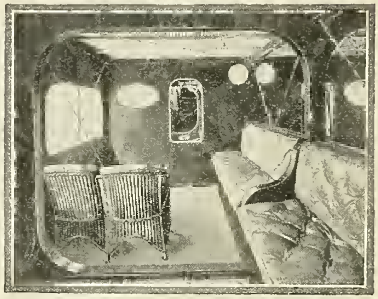
Customer—"Then I wonder if you'd be so good as to play a game of dominoes until I've finished my lunch."—*Punch* (London).

Generosity

Nurse: "Why, Bobby, you selfish little boy! Why didn't you give your sister a piece of your apple?"

Bobby: "I gave her the seeds. She can plant 'em and have a whole orchard."—Kingston *Standard.*





Thirty passengers find comfortable accommodation in the luxurious cabin of the Airliner. In the view above but half of the cabin is shown

A New Giant Plane

STRIKING in appearance, unusual in design, is the Remington-Burnelli Airliner, with its span of 70 feet. The fuselage, built in the shape of an aerofoil, houses a cabin 14 feet wide and 20 feet long, the largest cabin ever provided on any heavier than air machine.

Mr. Vincent Burnelli, designer of the Airliner, writes:

> ". . . . The giant size of our plane necessarily caused us to believe that it would be difficult to locate shelter for it on the average flying field, and therefore it could be expected to experience considerable exposure. This required us to devote much forethought to the waterproofing necessary to prevent deterioration and failure of glue joints. We feel confident that in adopting Valspar for our finishing material we have to the greatest possible degree obtained our aim. Our confidence is based on extensive previous experience in weather-proofing aircraft."

From long experience Mr. Burnelli knew that Valspar is proof against water and weather, vibration, oil, and grease. And so—

Inside and outside, the Airliner is *Valsparred, of course!*

VALENTINE'S
VALSPAR
The Varnish That Won't Turn White

VALENTINE & COMPANY
Largest Manufacturers of High-grade Varnishes in the World
ESTABLISHED 1832
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TYPE
NEW YORK

OIL—ACE
PRACTICALLY PROVEN
ADVOCATING AERO MAIL

(*Continued from page* 83)

to slightly more than 1% at 2900 r.p.m. The efficiency and delivery of the pump are given in Fig. 4 and Table 2.

Table 2

Discharge head 2.0 ft.
Intake head .22 ft.
Length discharge hose 3.0 ft.

R.P.M.	*Delivery gal/min.*	*Efficiency %*
310	.314	16.9
405	.411	11.0
500	.519	9.5
600	.623	7.9
700	.725	7.0
800	.823	6.2
900	.917	5.6
1000	1.01	5.1
1100	1.12	4.4
1200	1.22	4.0
1300	1.33	3.3
1400	1.43	3.0
1610	1.66	2.2
2330	2.36	1.3
2900	2.75	1.1

Resistance and Power Characteristics.

The power required for driving the unit with the vanes unenclosed at a speed of 120 m.p.h. is nearly 2 HP., while with the vanes in the housing the power required is slightly more than one-half horsepower. Fig. 5 and Table 3 give the values found for the head resistance of the vanes and the power required at the various wind speeds and emphasize the advantage to be obtained by enclosing the vanes in a housing.

Table 3

Air speed	*Vanes Unenclosed*		*Vanes in Housing*	
m.p.h.	*Drag (lbs.)*	*HP. required*	*Drag (lbs.)*	*HP. required*
21.3	.184	.010	.057	.003
26.0	.275	.019	.075	.005
30.4	.377	.031	.106	.009
35.0	.501	.047	.130	.012
39.3	.630	.066	.168	.018
43.4	.763	.088	.201	.023
47.3	.906	.114	.250	.031
52.2	1.10	.153	.303	.042
56.5	1.29	.194	.355	.054
61.2	1.53	.249	.426	.069
65.5	1.77	.309	.487	.085
75.4	2.36	.475	.670	.136
85.0	2.97	.674	.864	.196
105.4	4.49	1.26	1.34	.376
122.2	6.09	1.98	1.79	.583

The dotted line in Fig. 5 represents the drag of a single vane held normal and concave to the wind. The data obtained in this test are in fair agreement with the results of Eiffel on a hemispherical cup 10 inches in diameter. Table 4 gives the comparative results.

Table 4

Air speed	*Drag*	*Values of K* 1)	
m.p.h	*lbs.*	*Eiffel*	*Author's*
29.6	.171		.0040
39.3	.302		.0040
43.9	.377		.0040
51.6	.522	.0034	.0040
65.1	.842		.0041
74.2	1.115		.0041
82.0	1.36		.0041
89.2	1.63		.0042
93.2	1.83		.0043
99.4	2.09		.0043

Combined Efficiency and Efficiency of the Vanes.

The term "Combined Efficiency" as used in this paper, is expressed as the ratio $\frac{P}{P_1}$, where P_1 is the power absorbed by the unit from the moving air stream (air speed × head resistance) and where P is the power output of the pump (delivery × total head pumped). The efficiency of the vanes is readily determined by dividing the combined efficiency of the unit by the efficiency of the pump. The results are summarized in Table 5, and the curves are given in Figs. 6 and 7.

Table 5

Air speed	*Efficiency of Vanes*		*Combined Efficiency*	
m.p.h.	*Unenclosed* %	*Enclosed* %	*Vanes unenclosed* %	*Vanes encl.* %
21.3		42.2	.43	4.66
26.0		38.5	.37	3.54
30.4		33.8	.31	2.66
35.0	2.13	31.2	.25	2.20
39.3	2.09	27.6	.21	1.72
43.4	2.02	24.4	.18	1.45
47.3	1.93	22.3	.16	1.21
52.2	1.81	22.0	.14	.97
56.5	1.67	21.4	.12	.82
61.2	1.58	21.2	.10	.71
65.5	1.49	20.8	.09	.61
75.4	1.37	20.2	.07	.47
85.0	1.36	19.5	.06	.34
105.4	1.39	17.7	.04	.30
122.2	1.37	16.4	.03	.17

These results again illustrate the decided advantage to be obtained by shielding the convex sides of the vanes from the air stream by some form of housing. At a wind speed of 60 m.p.h. the efficiency of the vanes is increased from 2% to 21% by the use of the housing, with a consequent increase in the combined efficiency of the unit from 0.1 to 0.7 per cent.

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1) The resistance may me expressed by the formula: $R = KAV^2$
Where R is the resistance of the body in pounds.
A is tthe area in square feet,
and V is the wind speed in feet per second.

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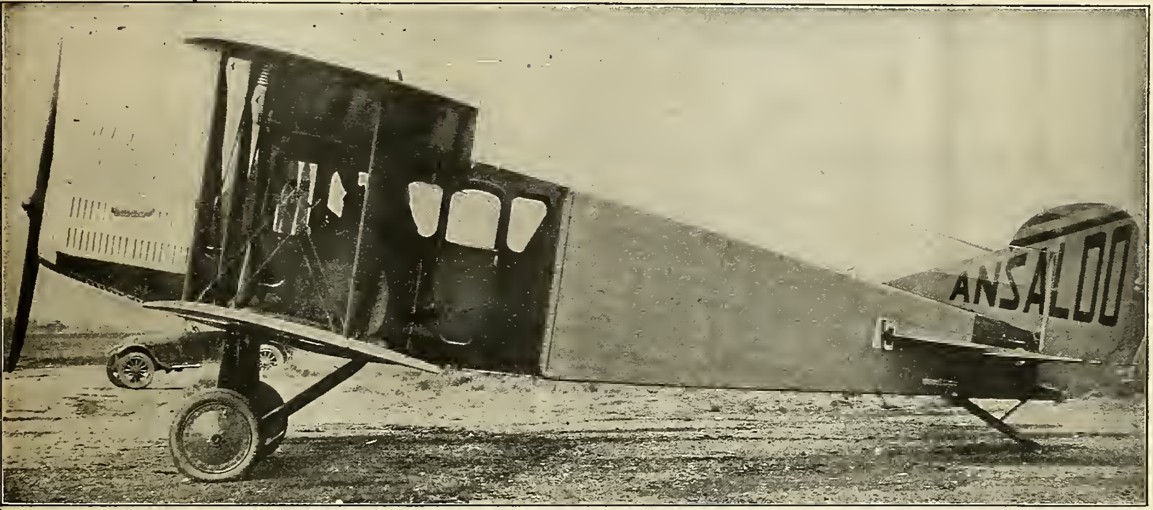

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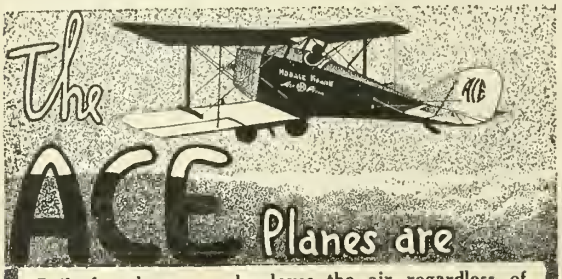

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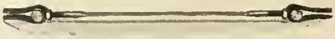

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STATEMENT OF THE OWNERSHIP, MANAGEMENT, CIRCULATION, ETC., REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912,

Of AERIAL AGE WEEKLY, published WEEKLY at NEW YORK, N. Y., for OCT. 1, 1921.

STATE OF NEW YORK }
COUNTY OF NEW YORK } ss.

Before me, a NOTARY PUBLIC in and for the State and county aforesaid, personally appeared G. DOUGLAS WARDROP, who, having been duly sworn according to law, deposes and says that he is the EDITOR of the AERIAL AGE WEEKLY and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Name of—	*Post office address—*
Publisher, AERIAL AGE CO., INC.	280 Madison Avenue, New York
Editor, G. DOUGLAS WARDROP	280 Madison Avenue, New York
Managing Editor, none.	
Business Manager, G. DOUGLAS WARDROP	280 Madison Avenue, New York

2. That the owners are: (Give names and addresses of individual owners, or, if a corporation, give its name and the names and addresses of stockholders owning or holding 1 per cent or more of the total amount of stock.)

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G. DOUGLAS WARDROP	280 Madison Avenue, New York

3. That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.)
NONE.

4. That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

5. That the average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the six months preceding the date shown above is..............................
(This information is required from daily publications only.)

G. DOUGLAS WARDROP,
Editor.

Sworn to and subscribed before me this 20th day of September, 1921.

DANIEL F. NUGENT,
Notary Public, Queens Co., 1701; Certificate Filed in N. Y. Co., 97.
[SEAL]
(My commission expires March 30, 1923.)

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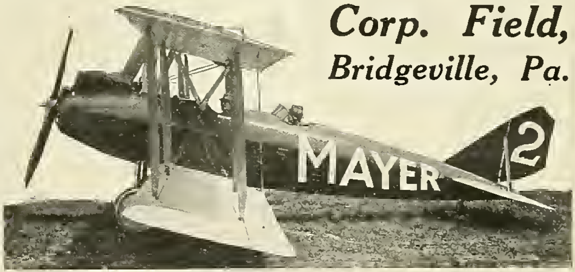

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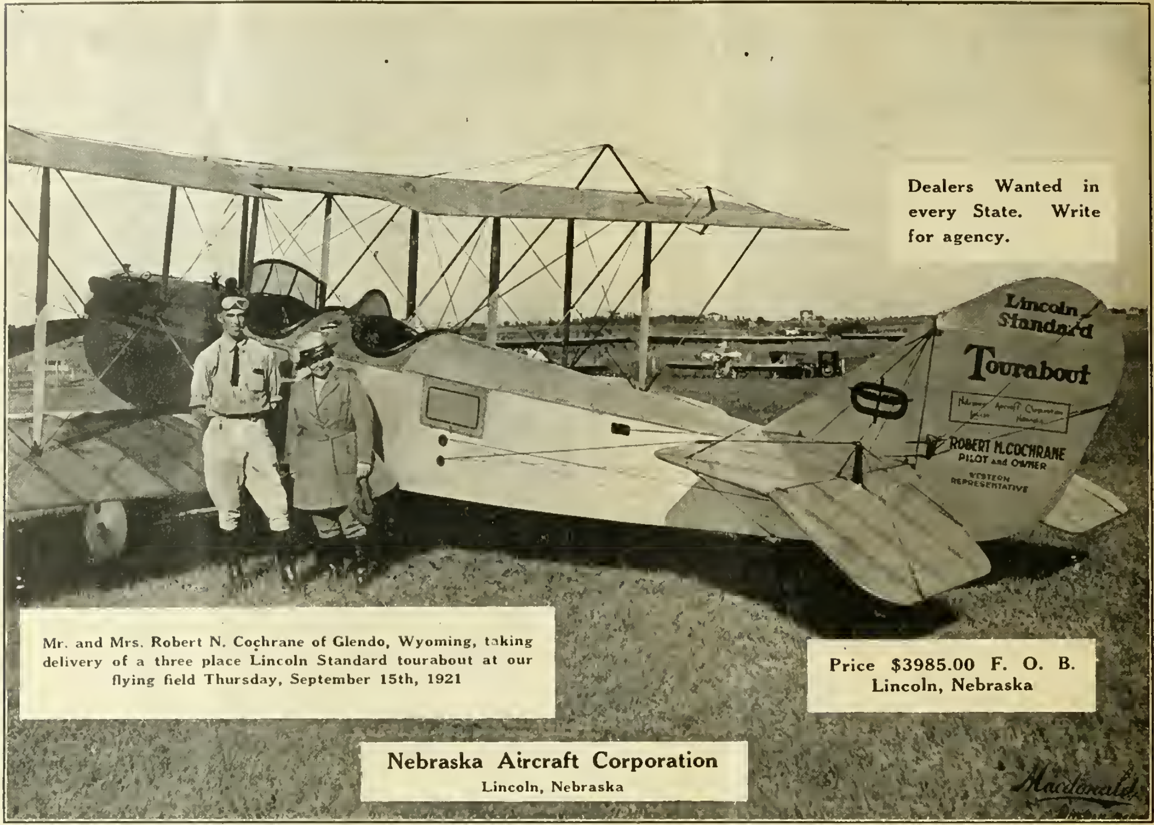

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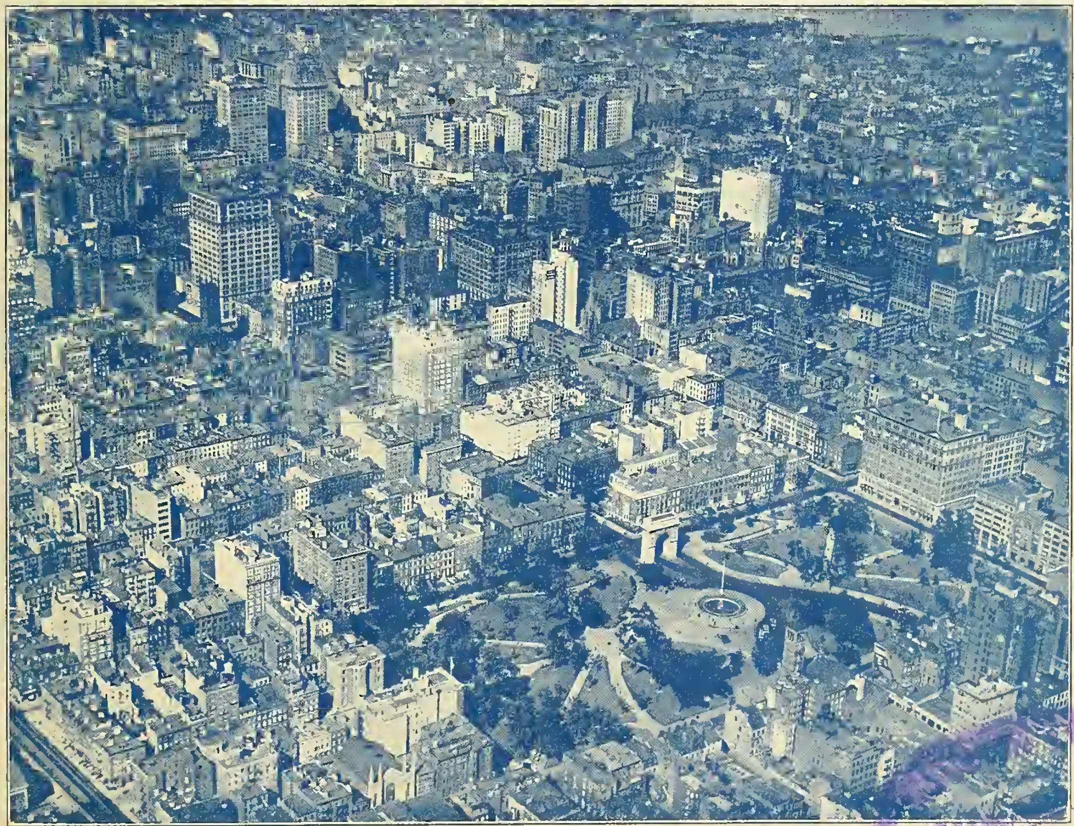

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Information for Pilots Giving the Practical Characteristics of the Land Along Various Air Routes

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
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American Legion
FLYING MEET

(In conjunction with the Third Annual American Legion Convention)

KANSAS CITY, MO.—OCT. 31—NOV. 1 & 2

A mammoth Spectacle of the Air for three days and nights. Meet your old buddies. Meet America's foremost aces and scores of other notables. See the greatest collection of ships ever assembled. And take part in your favorite events. A meet the world will talk about!

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Open to any make of plane, horsepower, or wing spread. Machines to start at scratch, race over a triangular course of 5 miles, 30 laps or 150 miles in all. Prize one leg on a cup costing $2500.00. This must be won twice to become the permanent property of the winner. Another beautiful cup, valued at $1200.00, will be awarded the winner of first place, as his permanent property. These prizes will be presented by the President of the United States on the floor of the Convention Hall. In addition, cash prizes of $3000.00 are offered for first, $2000.00 for second, and $1000.00 for third place.

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OPEN TO ALL! Our official booklet containing full information on each event, cuts of trophies to be awarded in addition to cash prizes, rules of the course and field, is now ready for mailing. This booklet also contains official entry blanks. Send for yours at once. Don't miss this greatest of all Flying Meets. Write today.

Flying Club of Kansas City

Room 126 Hotel Baltimore
Kansas City, Missouri

October 10, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 5

TABLE OF CONTENTS

General Mitchell on Bombing.... 99
The News of the Week........... 100
The Omaha Aero Congress........ 101
The Aircraft Trade Review....... 102
The Effects of Staggering a Biplane 103
Duralumin: Its Properties and Commercial Possibilities............ 105
The New Age 106
Information for Pilots Giving the Practical Character of the Land Along Various Air Routes....... 107
Naval and Military Aeronautics.... 110
Foreign News 112
Elementary Aeronautics and Model Notes 113
Aeronitis 114

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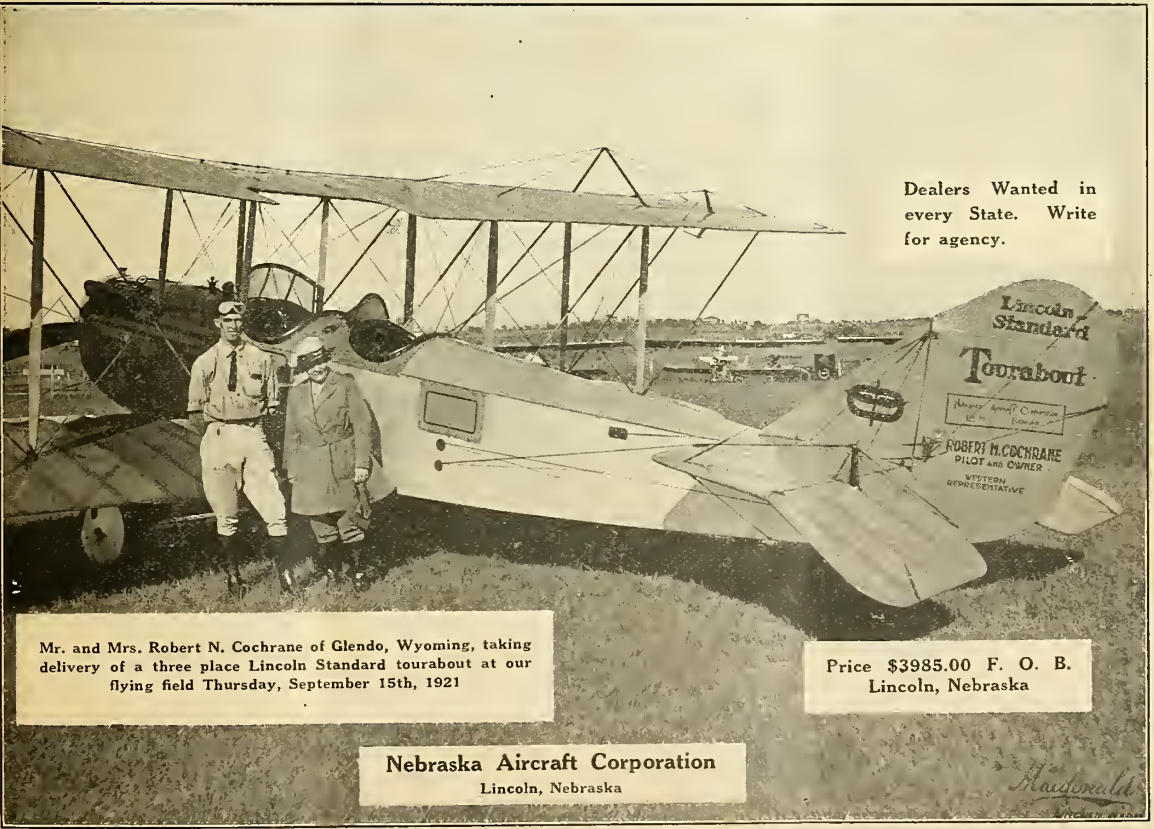

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VOL. XIV NEW YORK, OCTOBER 10, 1921 NO 5

GENERAL MITCHELL ON BOMBING

GENERAL MITCHELL'S report on the bombing of the German ships and his estimate of the lessons to be derived therefrom have never been published verbatim for reasons best known to the War Department. And yet it may be said that this report hits the target in every sentence.

Conservatism in the Army and Navy vainly seeks to depreciate aviation in war. It insists that weather, darkness, speed and zigzagging, anti-aircraft guns, etc., will protect fleets and forts. The General's report punctures and flattens all these theories. He says:

"Air forces can find and destroy all classes of sea craft under war conditions with negligible loss to the air craft."

This statement is unquestionably true. The Ostfriesland tests proved it by day and the Alabama tests by night. He says further:

"Conditions of weather affecting air and sea conditions do not alter the statement made above, as air craft can operate under conditions under which sea craft cannot operate. For instance, a sixty-mile wind, low visibility near the water and operations at night are very difficult for sea craft."

This statement is justified. A fleet is helpless at night. The Alabama was bombed at night. A fleet is helpless in a fog. Planes can fly above the fog and attack fearlessly as the fog clears. The rolling and pitching of ships in a heavy sea will prevent anti-aircraft guns from hitting anything. Planes can attack with impunity. General Mitchell goes on:

"The Army Air Service was not permitted to attack the targets as it would under war conditions, and never was more than one-tenth of the force employed in a single attack."

This statement is undeniable. In some cases planes were compelled to fly around over the targets with heavy bombs for a half hour, waiting for permission to attack. The General's report declares:

"Had the Army Air Service been permitted to attack as it desired none of the sea craft attacked would have lasted ten minutes in a serviceable condition."

This is not an overstatement. If the German ships had been under way their boilers, engines, magazines, ammunition, steering gear and communications would have been exposed. An attack in full force with bombs, torpedoes, mines and poison gas would have destroyed or put them out of action in a single flight over the squadron. It is not necessary to sink a ship to render her useless in battle. General Mitchell continues:

"The First Provisional Air Brigade could have put out of action the entire Atlantic Fleet in a single attack. The money value of the aeroplanes did not exceed the cost of one modern destroyed."

This statement is perfectly reasonable. Our fleet has no air force capable of resisting such an attack. The Navy Air Force has a splendid and gallant personnel, but it lacks the weapons with which to fight. Naval aviation has been suppressed and discouraged for years.

Anti-aircraft guns are the only hope of our fleet. They are practically useless. Masts, smoke pipes, bridges, searchlights, radio and fighting tops filled with fire control personnel blanket these guns almost completely. They are a broken reed. They would be no more effective than so many pea shooters.

And the Alabama tests have proved that the air force can attack the fleet at night. What could the fleet do? This situation is appalling.

General Mitchell's warning to America goes on:

"At present there is a complete lack of liaison or system about our national defence. The duties are distributed between the Army, the Navy, the air force, the coast artillery, the army corps area commanders and the coast guard in such a way as to make it impossible to function efficiently in an emergency."

This is absolutely true. Our system is one of chaos. It spells confusion, turmoil and complete unpreparedness for modern war. There is no head.—(Editorial in N. Y. *Herald.*)

THE NEWS OF THE WEEK

Lieut. McCready Establishes New Altitude Record

Dayton.—Lieut. John A. McCready, test pilot at McCook Field, flew a La Pere biplane to a height of 40,800 feet September 28, breaking the record heretofore held by Rudolph C. Schroeder, who drove the same biplane to a height of 36,020 feet on February 28, 1920. The height attained by Schroeder, however, was later corrected to the true altitude of 33,114.

At 40,800 feet McCready's engine died with a cough and the daring flyer glided back to the field without any difficulty.

McCready was in the air one hour and four minutes, and landed none the worse for his experience, although he encountered a temperature of 50 degrees below zero. He was able to leave the field soon after landing. He encountered little of the trouble that almost killed Schroeder, whose eyeballs froze and whose heart dilated to such an extent that he was in a hospital for two weeks after his flight. Lieut. McCready, however, said that throughout the flight he suffered nothing but numbness from the cold, particularly in his hands, which became so stiff he could hardly operate the controls.

"When I left the ground," said Lieut. McCready, "I did not intend to go above 30,000 feet. However, when I reached that height I found my machine was working perfectly, and I decided I could obtain some valuable data by going higher. I commenced to spiral, and soon reached 40,800 feet, when I was obliged to descend.

"At 20,000 feet the temperature on the thermometer registered zero. The only time I was scared was just as I reached the 30,000 foot mark. At this point I slowed up my motor. This cooled the cockpit of the machine and my oxygen supply pipe froze on me.

"I grabbed an emergency bottle of oxygen and inserted it through a valve in the side of the helmet. I broke the bottle and revived myself. Upon speeding up the motor I found that the ice melted and I was able to breathe again. I do not know just where I was when I reached the mark. I made the ascent in large circles, extending as I reached a high altitude entirely around the city of Dayton. I think perhaps I may have been between Middletown and Hamilton when I reached the mark. I could not see Dayton, but I could see the rivers where they converge.

"I was aided by many things which have recently come into use in aviation. I used a special gelatine on the inside of my goggles to prevent freezing. Although some ice did freeze on them I was able to see fairly well at all times.

"Nature was with me on the trip. It was an ideal day for an altitude flight. The visibility was perfect at all times and I was able to see land, as no clouds interfered.

"The wind at that height was terrific. I can't tell just how fast it was blowing or in what direction. I would notice in making my spirals that I was blown rapidly off my general course when on one side of the ring.

"I am glad I made the record, of course. I like to hold a record. Any man does. However, the data that I obtained at that height is what I was after and I owe the lack of suffering on the trip to the new and scientific appliances which have been invented within the last year.

"My eyes did not suffer at all on the trip. Major Schroeder on his flight froze his eyes. I was able to see at all times, although not so clearly at times due to the lack of air. I suffered more from the lack of air pressure on my body than I did from the other cause.

"I noticed all during the trip above 25,000 feet that my hands felt like lead and that I could not move freely. However, I was able to handle the controls and to send the ship just where I wanted her.

"When I reached the ground I was able to walk about and felt fine in a few minutes, although I was a trifle weak and stiff from the cramped position and the strain. I walked into the hangar and then into the flight commander's office, where I made my report on the data that I had collected."

The instruments on Lieut. McCready's machine were taken to the technical data office of the flying field as soon as he had landed, and were calibrated by Lieut. Patterson and a corps of assistants to ascertain the true altitude record. The altitude registered on the plane as showing the highest point reached was 41,200 feet, but the true height after being calibrated was 40,800. These figures will be sent to Washington for confirmation, but officials of the flying field said they are certain their calibration was correct and that the record will stand.

The plane used by Lieut. McCready is equipped with a supercharger recently invented by Dr. S. A. Moss. This is an attachment which takes care of the engine during altitude flights, and which automatically changes the mixture in the carburetor and keeps the water in the radiator warm at all times, regardless of the temperature encountered. The preparations for the flight, which was primarily to test the supercharger, were under the supervision of Dr. Moss and Capt. George Hallet, chief of mechanical designing at McCook Field.

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Assistant Secretary of the Navy Theodore Roosevelt, who flew to the American Legion Convention at Atlantic City from Washington, being greeted by Miss Elizabeth Edwards, daughter of the Governor of New Jersey.

The biplane which has now twice shattered the world's altitude record was designed in January, 1918, by Capt. La Pere, a French aviator working under the direction of the United States Government.

During the record breaking flight the aeroplane was equipped with a new propeller, larger than it had been equipped with at any previous time. This was used in an effort to increase the altitude capacity.

Aero Club Dinner

The Third Aviators' Armistice Day Dinner given by the Aero Club of America will be held at the Hotel Pennsylvania on Armistice night.

This is the annual reunion dinner of all the Air Service officers from all over the United States to live over again the battles of the clouds in France. Plans for the developing of the aerial defenses of the country for the coming year will be discussed by eminent men in brief speeches, and the support of every Air Service officer and all others interested in aviation enlisted in this important work.

The dinner committee is as follows: Benedict Crowell, Chairman; Cole J. Younger, Vice-Chairman; Brig. Genl. Wm. Mitchell, A.S.A., Rear Admiral W. A. Moffett, U.S.N., Eddie Rickenbacker, Harold E. Hartney, Caleb S. Bragg, Col. G. C. Brant, Col. E. Garnsey Brownell, Douglas Campbell, Maurice G. Cleary, Col. Chas. H. Danforth, Chas. Jerome Edwards, Comdr. Jerome C. Hunsaker, U.S.N., A. P. Leoning, David H. McCulloch, Charles E Merrill, Capt. W. C. Ocker, U.S.N., Comdr. Albert C. Read, U.S.N., Philip J. Roosevelt, Col. E. H. Shaughnessy, Major William Sherman, U.S.A., James B. Taylor, Jr., Col. William Thaw, Lt. Comdr. Kenneth Whiting, U.S.N.

Deutsch de la Meurthe Trophy

Etampes, France — Lieut. Georges Kirsch of France won the Deutsch de la Meurthe Cup race here on October 1st. He covered 300 kilometres (186.3 miles) with five turns in 1 hour 4 minutes 39 1-5 seconds, or at the rate of nearly three miles a minute.

Sadi Lecointe, the noted French aviator, was injured and his aeroplane was smashed when he made a forced landing in the first lap of the race. He suffered wounds about the face, may lose his right eye and has deep cuts in both legs. His propeller was shattered while he was going faster than 300 kilometres an hour.

Lecointe was first to take the air, and had made splendid time for the first fifty kilometres, flying this distance in 9 minutes 33 4-5 seconds.

In winning the race, Lieut. Kirsch did even better than Sadi Lecointe, who in the James Gordon Bennett Cup race covered the same course in 1 hour 6 minutes 17 1-5 seconds.

Lannes, the other French pilot, who used the machine piloted by Lecointe last year, was the only other entrant to finish the race. He went over the course in 1 hour 9 minutes 55 2-5 seconds.

The British and Italian entrants abandoned the race after negotiating 100 and 150 kilometres respectively.

The Omaha Aero Congress

Aces of the World War, the intrepid chaps whose every flight over the Boche lines made constructive American history, will be buddies again with the "deuces" of Kelly Field and the air generals who fought the long seige of Chatillon-sur-Seine and Issoudon and the strident notes of, "Hail, Hail, The Gang's All Here" will render the air at the first International Aero Congress in Omaha, November 3rd-5th.

To date, 10,246 of them have been directly approached with insistent invitations to attend. Omaha will be the Flyers' Mecca November 3, 4 and 5, and the International Aero Congress shows every indication of bearing the same relation to the infant Aviation that the forthcoming Disarmament Conference bears to the world's peace, inasmuch as it will disarm the American public of its scepticism and seeming indifference toward aviation as a vast, far-reaching industry of the future.

The feature of the meet, of course, is the second annual contest for the Pulitzer Trophy, the stellar speed event of the upper strata. Entries must attain an air speed of one hundred and forty miles per hour to qualify for this event. Equal to the Pulitzer Trophy is the new Larson Trophy donated by John M. Larson, of New York, for efficiency of planes included in the class referred to as "commercial."

This is the latest acquisition to the imposing lists of trophies and cash prizes which totals $14,000.

The additional racing events are as follows:

November 3—Event No. 1. Pulitzer Trophy Race. First prize $3,000; second prize $2,000; third prize $1,000. Free-for-all race for high speed planes. Distance one hundred and fifty miles. Event No. 2. Acrobatic Contest. First prize, $250; second prize $150; third prize $100. Free-for-all contest for all types of planes. Contestants must climb three thousand feet directly over field before starting acrobatics.

November 4.—Event No. 3. Larson Trophy Derby. First prize $3,000; second prize, $2,000; third prize, $1,000. Race for all types of commercial aeroplanes. Distance two hundred and fifty miles. Event No. 4. Free-for-all race. First prize $300; second prize, $150; third prize, $125. Race open to JN4's. OX5 Standards, Orioles with Curtiss OX5 motor, Canucks and other planes with a speed from sixty to seventy-five miles per hour. Distance ninety miles. Event No. 5. Free-for-all race. First prize, $300; second prize, $150; third prize, $125. Race open to JN4H, C6, or K6 Orioles, Laird-Swallow, Bellanca CE, Lark, C6 or K6 Standard or equals a speed of seventy-five to ninety miles per hour. Event No. 6. Parachute jumping contest. First prize, $200; second prize, $100; third prize, $50. Open to all parachute jumpers.

November 5.—Event No. 7. Open race. First prize, $1,500; second prize, $700; third prize, $375. Closed handicap. Open to all machines. Distance one hundred and fifty miles. Event No. 8. Bombing Contest. First prize, gold cup; second prize, silver cup. Open to army and navy planes only.

The International Aero Congress will be an occasion for the reunion of the Lafayette Escadrille, the living American Aces, flyers who won the Distinguished Service Cross, former officers and enlisted men in the Air Service and Balloon Corps of the squadrons that fought the Hun in 1917 and 1918.

Invitations have been extended to Marshal Foch whose attendance is very probable; also to the Prince of Wales, Sir Douglas Haig, General Armande Diaz of Italy, and General Pershing and a score of other notables.

For the airmen attending, group reunions and banquets together with all the types of entertainment dear to the flyers' hearts will be given in their honor and on the last night, the closing feature will be the "Destruction of Courcellette," the aerial night pageant written by Rupert Hughes and Eddie Deeds, to be produced under the direction of the latter. A cast of seventy-five people will be used in the production and the French Village will be destroyed by Hun planes from the air which are subsequently downed by an American Ace.

A charming romance has been selected as the theme of the story and the illuminating effects will be under the direction of Mr. W. D'A. Ryan, the designer of the "Tower of Jewels" of the San Francisco Exposition. The General Electric Company is supplying an eighty million candle power searchlight to illuminate the air battle, which in itself will be a feature attraction.

The congress will be particularly valuable to aircraft manufacturers, as their market will be concentrated in one city for the first time in history. All who attend are asked to come prepared to look over the aeroplane market, as well as the accessories market, with a view of purchasing at this time.

S. E. J. Cox of Houston, Texas, was the first Pulitzer entrant to plant down his deposit fee. He is entering two crafts, one the Texas Wildcat, with C. B. D. Collyer as pilot, and the other the Cactus Kitten, with Clarence Combs at the stick.

The Aero Club of Utah has also pledged an entrant—a Thomas-Morse, with E. D. Steely as pilot. The Sioux City, Iowa, Flying Circus will have an entrant also, and four others have promised to have their entries in soon.

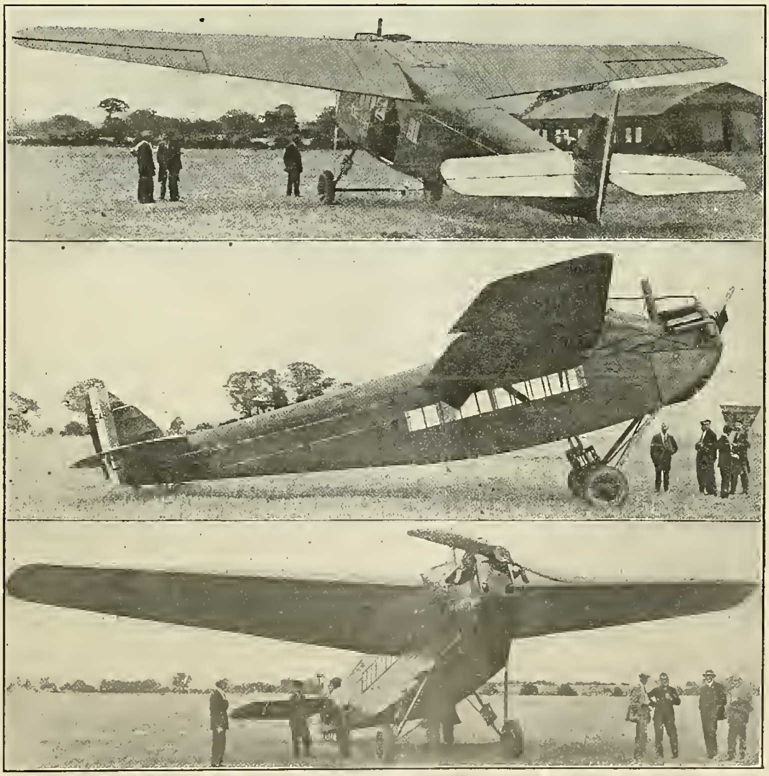
Nearly one hundred flyers of the middle west have promised to bring their craft to Omaha to take part in the other races and contests.

The Larson Trophy contest, details of which will be issued soon by the Aero Club of America, according to Captain Hartney will be interesting. Any craft is eligible, as the winning of the contest will be based on the formula $\frac{(w - t)\,s}{g}$, in which (w) stands for total weight leaving ground, (t) stands for weight of plane minus gas, (s) stands for miles per hour actually made over the course, and (g) for amount of gas actually consumed.

The course in the Larson contest will be 250 miles in length from Omaha to Des Moines and return. Most of the other races will be run over the 30 mile course which starts at Omaha Field.

The field has been prepared at a cost of nearly $50,000; Aero Club members helped prepare the field in their spare time, and the city spent nearly $30,000 in the construction of a sewer which traverses the field.

Entry blanks for participation in any of the races or contests of the International Aero Congress in Omaha may be had by writing to the Omaha Aero Club, Hotel Fontenelle, Omaha, Nebraska, U. S. A.



The latest British Airliner—the De Havilland 29, with Napier Engine. It is a cantilever Monoplane with capacity for ten passengers. Photo courtesy "The Aeroplane"

The AIRCRAFT TRADE REVIEW

California-Curtiss Company Organized

Erving G. Diess and Earl S. Daugherty, noted aviators and United States instructors during the war, have formed the California-Curtiss Aeroplane Company and have been appointed distributors for Curtiss aeroplanes for Southern California and Arizona.

Field headquarters will be maintained in Long Beach, where a $50,000 plant is to be established, and an office will be located in Los Angeles. Curtiss aeroplane agencies, under direction of dealers such as now obtain in the automobile industry, are to be promoted for the sale of machines and the promotion of the industry.

Diess and Daugherty have formed a partnership so as to combine two of the most prominent aviation factors in the West under one head. As a sales manager and aviator, Diess has sold probably more aeroplanes than any one individual in Southern California. As an aviator, Daugherty has been an exhibition and passenger carrying pilot for years, having obtained one of the first licenses issued by the Aero Club of America through the Aero Club of California.

Daugherty field at Long Beach is to be improved and equipped to meet the up-to-date demands of the fast developing aviation business. Hangars with concrete floors are to be built to house 10 planes, there will be a runway 3000 feet long and 290 feet wide, field offices and warehouses for storing parts are to be erected.

The company will handle aeroplane motors besides fully equipped machines. It will also have service stations where repairs can be made and planes and motors overhauled. A full stock of parts will be kept. Pilot and mechanical instruction will be given. Standard Curtiss machines will be handled, including the JN-4D planes, Orioles and Seagulls. Motors will have horsepower of 90 to 150.

It is proposed to show that aeroplanes are adaptable for rapid intercity transportation by business men, oilmen, cattlemen, ranchmen and sportsmen, especially to reach isolated places. As an example, a plane has been actively in use by an oil man who maintains his home here but makes frequent—sometimes daily—trips to Bakersfield oil fields. Another use made of the Curtiss Seagull type, sold by Mr. Diess to the Canners Fish Co., is to send out a seaplane to locate schools of fish and wireless the information to the fleet, which immediately puts out from Los Angeles and Long Beach harbors for the fishing grounds. Motion picture studios and film stars have purchased a number of planes both for professional and private use.

Bellanca in Omaha

Prof. Giuseppe Bellanca, who has designed a number of efficient aeroplanes, is now associated with the Omaha Aircraft Co., and is now engaged in the design of the Bellanca C. F. Monoplane, which will be an enclosed cabin machine with seating capacity for four passengers and pilot, with a baggage compartment with sufficient space for personal baggage.

R. E. Davis is the general superintendent of the company, and E. T. Richards is manager in charge of sales.

Trunk Lines in Air Foreseen Next Year

Pittsburgh.—Biplanes now under construction will carry passengers from this city to New York or Chicago in three and one-half hours, and will be operating within the next year, according to plans laid before the Pittsburgh Chamber of Commerce. Representatives of a West Virginia corporation having the planes built at Gloucester City, N. J., said the first plane would make its initial trip to Pittsburgh next month.

A site for a flying field in Pittsburgh, lack of which recently prevented the landing of a Fokker monoplane from Philadelphia, has not been selected, it was said, but Colonel John Jordan, former chief of construction of the United States Air Mail Service, will accompany other engineers here soon to inspect locations.

The speed of the new planes, it is announced, will enable passengers to leave Pittsburgh any morning, transact business in either New York or Chicago and fly home in time for dinner.

The new biplanes are to have a wing spread of seventy feet. Express planes will have a cargo capacity of one ton and the passenger planes will carry thirty persons. Express planes will be driven by Liberty motors of 450-horsepower and the passenger craft by twin motors of the same power.

The express lines are to be placed in operation first, to be followed by the development of passenger transportation. Six trunk lines projected include: From New York to Pittsburgh; New York to Chicago, Cleveland, Washington and Boston; Pittsburgh to Cleveland, Chicago, Washington, Cincinnati and Buffalo, with combination routes through the Middle West and to the Pacific Coast.

New York-Havana in 19 Hours

The Aeromarine Navy HS-2 six-passenger flying boat "Presidente Zayas" which left New York on September 23rd, arrived at Havana on September 25th, the actual flying time being nineteen hours and the distance 1,521 miles.

The flying boat made stops at Atlantic City, Beaufort, S. C., Miami, Fla., and Key West.

Those who made the initial trip were Miss Dona Moberly, Miss Gladys Carruthers, Mr. F. Lopez de Haro and Mr. Alegario Monte. D. G. Richardson and Richard Greisinger were the pilots.

A delegation from the Aero Club of Havana and representatives of the Cuban Government welcomed the craft when it arrived. The flight of the Aeromarine "Presidente Zayas" opens the Southern season of the Aeromarine Airways. The present schedule calls for the departure of two boats a month for Havana from New York City; this will undoubtedly develop into a weekly service before the first of the year. Last season the price of a flying boat ticket to Havana was $750. Today the fare has been reduced to $250 per passenger, which compares more than favorably with the railroad price which is around $140.00.

Under the new schedule it is possible for passengers to board an Aeromarine Flying Boat in New York in the morning; fly to Beaufort, S. C., the first day, transfer there the following morning to another boat which has been held in waiting and fly to Miami, where another transfer is made, and from there on to Key West and Havana, arriving in Havana the afternoon of the second day.

By railroad and boat a passenger does not arrive in Havana until the morning of the fourth day.

According to cable reports received at the Aeromarine office in New York City, all four passengers were enthusiastic about the flight and have avowed their intention to return to New York the same way.

Pilots Endorse Licensing

Kokomo.—Federal licensing of pilots after rigid examinations was proposed at the Congress of Aviators September 22, attended by more than one hundred pilots from flying fields throughout the United States. Necessity for strict regulations for flyers was pointed out in an address delivered by R. W. Schroeder, holder of the world's altitude record.

Planes Are Used to Get Jobs for Idle

Philadelphia.—Business and industrial men of Philadelphia were having visualized to them September 15 the unemployment situation in this city—from the air.

To impress the leaders of commerce and industry here with the necessity of finding jobs for the jobless, the industrial relations committee of the Chamber of Commerce began flights with business executives here to show them the idle plants and industries in this city.

Idle freight cars in railroad yards, smokestacks from which no smoke is coming, mill yards in which there is no activity and other examples of unemployment are shown in the flights.

This is all in line with the adoption at a recent meeting of the industrial relations committee of the chamber of a resolution, which was signed by fifty-four business and industrial executives of the city, pledging themselves to seek jobs for the idle.

The Chamber of Commerce announced that in a few days aeroplanes will visit Washington, New York and Pittsburgh to deliver to those places copies of the resolution adopted here.

THE EFFECTS OF STAGGERING A BIPLANE

By F. H. NORTON

Langley Memorial Aeronautical Laboratory

(Technical Note of the National Advisory Committee for Aeronautics)

Summary

THIS investigation was carried out by request of the United States Air Service at the Massachusetts Institute of Technology wind tunnel in 1918. As the data collected may be of general interest, they are published here by the National Advisory Committee for Aeronautics. The lift, drag, and center of pressure travel are determined for a biplane with a stagger varying from +100% to —100%. It is found that the efficiency and the maximum lift increase with positive stagger. With large positive staggers the center of pressure is far forward and has a very slight travel with changes in lift coefficient.

Introduction

As staggered biplanes have certain advantages from the point of view of visibility, it was thought that a more complete investigation of the aerodynamic effects of stagger than had been done before would be of considerable value. Particular care was taken to examine the pitching moments of the various combinations, as they showed very interesting characteristics.

The references to work already done on stagger are given below:

Some Stable Biplane Combinations, J. C. Hunsaker;
British Advisory Committee R. & M. No. 196;
Nouvelles Recherches sur la Resistance de l'Air et l'Aviation, Eiffel.

Methods

The wings used in this investigation were an aluminum U.S.A.15 section as an upper wing, and an R.A.F.15 section as the lower. Identical sections were not employed, as none were available, but the two sections used had very similar properties, and previous tests have shown that the individual properties of the wings have little influence on the biplane characteristics. When comparing the biplane with the monoplane the average of the two wings was taken as the monoplane value. The characteristics of these wings are shown in Fig. 1.

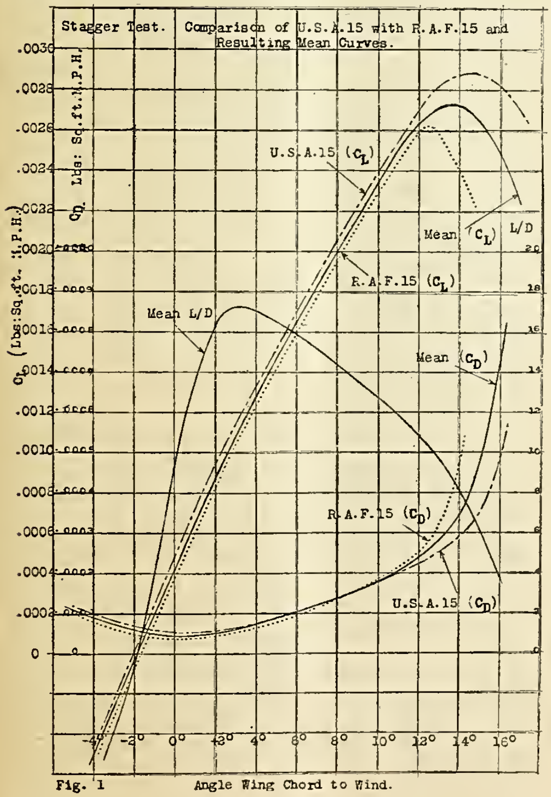


Fig. 1

The wings (3" x 18") were supported at the lower end by a streamlined cross bar which was attached to the N.P.L. balance spindle. The upper ends of the wing were connected by a very light strut whose resistance was carefully determined for each case. The gap chord ratio was one in all cases. The speed of test was 13.4 m.p.s. (30 m.p.h.).

Precision

The wings were lined up in each case to 0.05°. In every case three separate runs were made, resetting the wings each time. In nearly every case the reading checked within 1%, so that the average may be considered correct to better than this amount. It was necessary to obtain this rather high precision as the differences between different cases were generally small.

Results

It was thought most convenient to plot C_L, C_D, * L/D and C.P. against stagger for each angle of attack (Figs. 2, 3, 4, 5). The effect of stagger is clearly shown by these curves and needs no discussion. For the use of the designer, correction factors to change monoplane values to those of a staggered biplane, are given in Table 1.

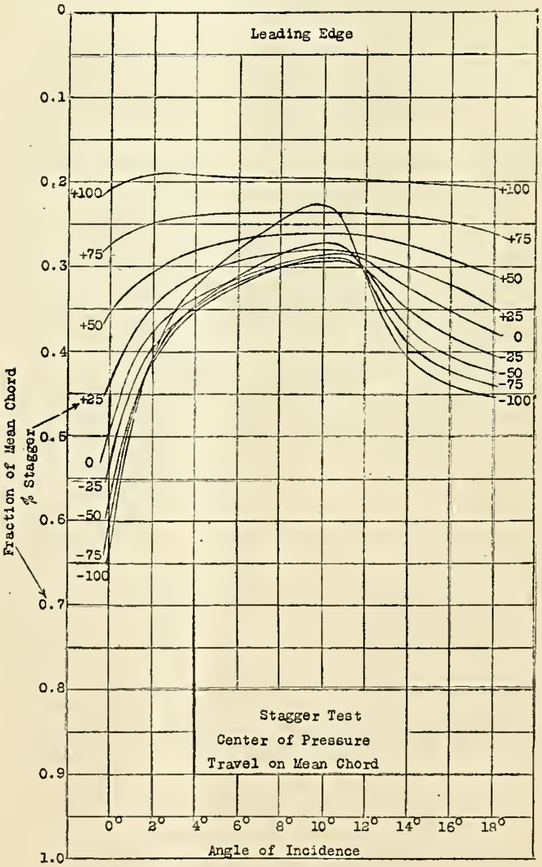


Fig. 5

$*\ C_L$ = Lift, L; absolute coefficient $= \frac{L}{qS}$ $q = \frac{1}{2}\rho V^2$; S = area

C_D = Drag; absolute coefficient $= \frac{D}{qS}$ V = True air speed

ρ = Density (Mass per unit volume)

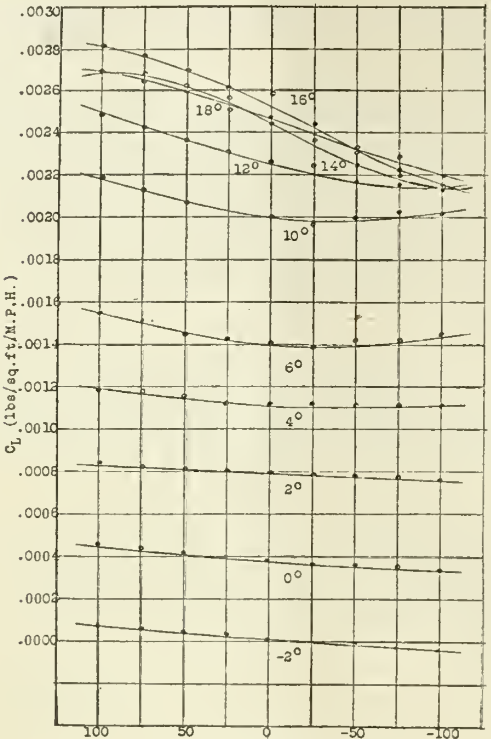


Fig. 2. Stagger test C_L vs. stagger.

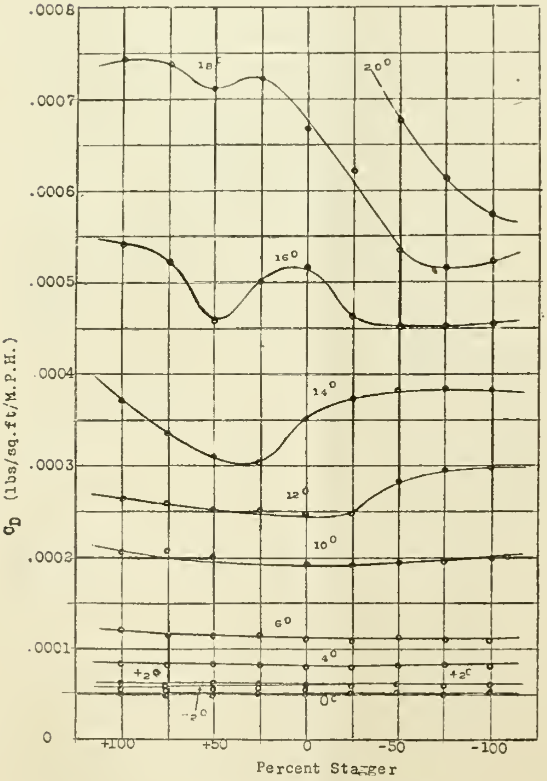


Fig. 3 Stagger Test C_D vs. Stagger.

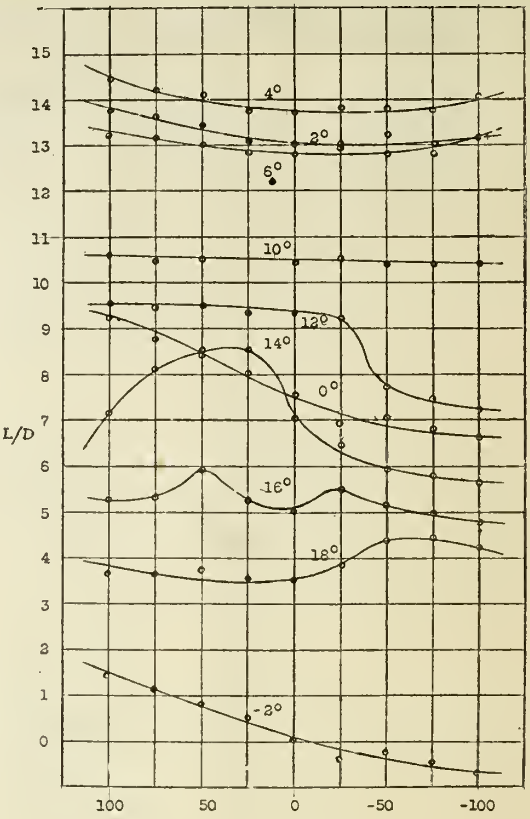


Fig. 4 Stagger Test L/D vs. Stagger.

TABLE 1.

CORRECTIONS FOR STAGGER

(Monoplane values to be multiplied by these factors)
Gap/chord ratio is one.

LIFT CORRECTIONS

i	+100%	+75%	+50%	+25%	0	—25%	—50%	—75%	—100%	i
—2	1.75	1.25	1.00	.50	.25	—.25	—.50	—.88	—1.35	—2
0	1.07	1.00	.95	.91	.86	.81	.79	.76	.74	0
2	.93	.92	.90	.89	.88	.88	.87	.86	.85	2
4	.92	.91	.89	.87	.87	.86	.86	.86	.86	4
6	.93	.91	.89	.87	.85	.84	.85	.86	.87	6
8	.93	.91	.89	.87	.85	.84	.85	.85	.87	8
10	.93	.91	.89	.87	.85	.85	.85	.85	.86	10
12	.94	.92	.89	.87	.85	.84	.82	.81	.81	12
14	.99	.98	.96	.92	.88	.85	.82	.80	.79	14
16	1.13	1.11	1.09	1.05	1.01	.97	.93	.89	.86	16

L/D CORRECTIONS

—2	—2.24	—1.57	—1.00	—0.57	—0.14	0.28	0.56	0.90	1.00	—2
0	0.98	0.94	0.90	0.85	0.80	0.75	0.73	0.72	0.71	0
2	0.85	0.84	0.83	0.81	0.80	0.80	0.80	0.81	0.82	2
4	0.85	0.83	0.82	0.81	0.80	0.80	0.80	0.81	0.82	4
6	0.84	0.83	0.82	0.81	0.81	0.82	0.82	0.82	0.83	6
8	0.84	0.84	0.83	0.82	0.82	0.82	0.82	0.82	0.83	8
10	0.84	0.84	0.84	0.84	0.83	0.83	0.83	0.83	0.83	10
12	0.86	0.86	0.86	0.85	0.84	0.83	0.70	0.66	0.65	12
14	0.89	1.00	1.05	1.07	0.88	0.80	0.75	0.72	0.70	14
16	1.57	1.60	1.78	1.57	1.52	1.65	1.54	1.50	1.42	16

Conclusions

This test shows that it is advisable from the point of view of aerodynamic efficiency to use the highest possible degree of stagger. Moreover, a positive stagger greatly restricts the center of pressure travel, thus simplifying the problem of stability.

DURALUMIN: ITS PROPERTIES AND COMMERCIAL POSSIBILITIES

By WILLIAM B. STOUT*

A MATERIAL one-third the weight of cold-rolled steel yet with the same approximate strength characteristics; a metal which can be heat-treated to higher physical properties, yet by a process which does not take effect for an hour after treatment; a possibility for much lighter and at the same time cheaper production in certain lines of manufacture; and in a few words you have a picture of the future possibilities of the new copper-aluminum alloy known as "duralumin."

Receiving its first impetus in the development of aircraft abroad, and particularly by the Zeppelin firm, this metal has been perfected in this country to a point far ahead of the German product, while the work in aircraft of both the airship or lighter-than-air type, and aeroplane or heavier-than-air machine, has developed processes and methods now applicable to new lines of production.

The new alloy can be rolled into sheets or forged by hand press or power hammer. It can be cast, welded and soldered, while rivets of the same material used with it show new production possibilities on account of the peculiarity of the heat treat resultants. Connecting rods have been made of it, using the metal itself for wearing surface without anti-friction metal. These have operated successfully in both motor cars and aircraft engines. Worm gears have been used made of "dural" as it is colloquially called, and used in heavy truck service successfully against steel pinions. Timing gears of this metal show new possibilities of both wear and quietness, but the most use has been in structural shapes for ultra-light constructions. The metal itself costs about five times as much as cold.rolled steel per pound. For production work, however, remember that but one-third the number of pounds is used for the same strength result, while the material being much easier to work than steel in most of its forms saves materially on labor tool cost and tool depreciation, and on enough production items so that in many cases constructions can be made cheaper of duralumin than of steel.

The work we have been following has been entirely along the line of minimum weight structures of fairly large size for aircraft work. The saving of a pound in an aeroplane structure means the addition of a pound of fuel in flight or a pound of pay load, so that in aircraft more than anywhere else minimum weight is a vital item. Strength is, however, no less fundamental, as an aeroplane in flight at speed it subject to stresses far greater than those imposed on an automobile on the road or any form of present transport. Imagine having to build a motor truck of two-ton capacity that could run across a ploughed field at 70 miles an hour without breaking up. This alone would be some engineering problem, yet some modern planes of the bomb-carrying type are designed to do and do do this.

Structures are now being built of duralumin which far exceed former strength figures in wood and yet which are lighter than any previous wood-and-cloth aeroplane constructions. We have at present in process machines capable of carrying twenty passengers at two miles a minute for five hours, and fitted with six hundred horsepower engines, yet the whole machine weighs but the same as a Cadillac touring car. The entire secret of the weight result is of course not all in metal, but it is safe to state that the light weight figure could not have been reached with our present knowledge with any other known material.

Many have preferred steel in their experimental aircraft work on the basis that steel in tensile strength was stronger than dural even weight for weight. This is so, but the problem of strength in a structure is not ordinarily of tensile possibilities but of column or compressive strength.

For the same weight, duralumin has about three times the thickess of even cold-rolled boiler plate counterpart, and five or six times the section of alloy steels of high tensile. The rigidity of a sheet is dependent on its thickness very largely, and while dural is a much more flexible material than steel in equal sections, yet with the greatly increased sections used for equal strength a much greater rigidity is obtained than with steel.

For example, we have produced a rolled section, designed for a maximum column strength, and yet of such shape as to fit production requirements. This section of .035 thickness of metal in a 19-inch column length weighs 7½ ounces and will support as a column 4 tons plus. If made of steel of high alloy, its thickness would be, so far as tensile requirements go, about .009, a too great fragility to be trustworthy in a structure on account of the lack of rigidity of such a thin wall.

Duralumin, as we see it, looks very like aluminum except that it takes a high polish, and that when polished the glinting red of the copper in the alloy can be detected.

The polish in ordinary atmospheres is permanent, the metal being non-corrosive to a very high degree. In the tempered state it is almost impervious to salt spray, though in the annealed form salt water affects it.

The chief difference between this and previous aluminum alloys is its property of having its physical characteristics materially changed by proper heat-treatment. This heat-treatment in itself acts differently than with other metals, leading to some peculiar production possibilities.

Like all new things, this metal with its peculiar properties has certain assets and definite liabilities, but even its liabilities, in some cases, can be termed a profit, provided the structures made of the metal are designed to fit the peculiar requirements of the alloy.

The most marked difference in the metal is that the change in physical properties following heat-treatment is not instantaneous but very gradually rises to a maximum after about four days, and during this period not only is the tensile strength increased as high as 50% or more, but the elongation increases from 600% to 800%. More than this, the metal in its heat-treated form can be re-heated and softened for passing through mechanical processes not of too violent a nature, and at the end of one hour come back to its original tempered characteristics. The fact that the extreme properties of the metal are not reached immediately, as in most metals, is of great advantage commercially, as will be explained later.

The heat-treatment of the metal, or tempering, as it might be called, consists of heating the metal to 920-940 degrees Fahrenheit for from 7 to 30 minutes, the time being governed by the amount of metal in process. The material is then quenched in boiling water. It is then removed from the quenching bath and worked upon as soon as possible. In from one to two hours' time enough hardening will have taken place so that it will be difficult to work the metal. Where the time involved in making up the piece does not exceed one hour and where the bendings or hammerings are not too severe, this process is a thoroughly feasible production method.

This allows us in our aeroplane work, for example, to heat-treat a coil of sheet metal in a bath of sodium and potassium nitrates, quenching in an adjacent tank of boiling water and uncoiling the sheet or strip, start it immediately through the rolls which form it into the shape desired, having our complete process over and the spar ready for aging within 20 minutes from the beginning of the operation.

It is not my intention to go into any of the technical details or metallurgical study of the scientific side of this new alloy, but rather to point out the numerous possibilities opened up by its use and to describe and explain some of the results and processes now being obtained with duralumin, primarily in aircraft work. I will only state that the metal itself is nothing other than a copper-aluminum alloy, the copper running about 4%, and some magnesium, but with zinc as the most detrimental component. For this reason, duralumin is made only from the purest 99% aluminum, so that the impurities in each of the alloys from which the metal is formed will not build up a detrimental quantity. It is the inability of the Germans to obtain pure aluminum which has hindered their duralumin alloy from equaling the figures obtained in every-day production from the American product.

The metal itself, however, was developed in Germany from an original French laboratory development. The first real commercial use to which it was put, so far as the public was concerned, was in the metal ships of the Zeppelin Company. One of the reasons for the slow development of the Zeppelin, aside from the problems of airship design itself, was the necessity of developing the metal along with the structure, and it is certain that the material, unless rightly handled, has as many idiosyncrasies as a New England spinster, as well as being as temperamental as a coloratura soprano from Grand Opera.

In the early metal considerable trouble was had with corrosion and with sheets, seemingly without reason, granulated, and until the properties and difficulties were worked out, structures built of the material were more or less uncertain and required frequent inspection. This is still true in very thin gauges which are not very carefully heat-treated, but with pieces of any real section, corrosion is now an almost unheard-of thing.

In the following outline I will give merely our own experiences with the present liabilities of the material and things to be watched out for in its use, but in criticizing I would, at the same time, state my belief that duralumin and derivatives which will spring from it will form undoubtedly the mainstay of all future light-weight developments in automotive and kindred structures, and that the use of this metal will grow by leaps and bounds as its marvellous advantages in both structure and production become very generally known and understood.

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* Paper presented before American Society for Heat Treating, Indianapolis.

The main trouble had with duralumin is more or less similar to the problem met in other alloys, that is, the presence of impurities in the ingot, or air bubbles, small in their original forms, but which, when worked out and forged into thinner sections developed into serious defects.

Most of our material is of .035 stock, so that a very small speck of dirt can make a serious flaw in the metal sheet and a very small air bubble can make considerable pipe in the center of the sheet, almost impossible to find except by microscopic examination, added to considerable good luck.

Most of these flaws do not show up until after the rolling. In this case the greatest stress on the metal in putting it through the rolls is at a hidden point, so that to inspect these spars or chord members a dental mirror is used with a high light, and the surface very carefully examined. Frequently a hole as small as the point of a fine needle can be opened up into a flaw five inches long—a sort of stratification of the metal resulting from original ingot impurities.

At the beginning of our work, spar rejections, for this reason, ran as high as 400%, this gradually being reduced, and it seems possible in the near future that our rejections will be normal. In all these sections there has been no attempt at drawing the metal, but merely bending it, as any attempt to draw the metal results in an extreme number of rejections through cracking. It is peculiar that these cracks may not appear until a number of hours after the piece is made, so that after rolling four day is allowed to elapse before parts can be inspected for cracks or flaws, or before any piece is allowed to be put into the actual aeroplane structure.

In the design of the rolls also great care must be taken against too great a degree of draw between annealings, and that all radii are of sufficient amplitude for the metal.

The great drawback of the material as we are using it at present is the presence of ingot flaws, rolled out in the sheet, which lead to a very high rejection cost. When this is cured, we can say, I believe, that the experimental stage of duralumin is over. As soon as quantities of the material are demanded also rolls can be put in for greater widths of sheet than at present available—sixteen inches being now the best obtainable—and tubing and other structural forms can be made available.

I believe that this material, and developments from it in better alloys, will eventually be more universally used than steel for structural requirements. Its use in aeronautics is already definitely established, new as its use is, and the all-metal plane already given preference to the older types. I believe we will next see it in motor cars, at a saving of over half the weight, and in boats and busses, street and railway cars, bridges and girders. For the time being, however, it is a material to watch and study, and to make use of conservatively in conservative lines of engineering.

Composition:

Copper	3.50 to 4.00%
Magnesium	.2 to .75%
Manganese	.40 to 1.00%
Aluminum (99% pure)	Balance

Physical properties:

Specific Gravity	2.80
Weight	102 lbs. per cu. in.
Melting Range Centigrade	540 to 650
Compressive Strength tempered	44,000
Shear Value tempered	30,000
Tensile Strength tempered	50-60,000
Percent elongation tempered	16 to 20%
Modulus elasticity	10,600,000
Coef. expansion	.00000226 per degree C.
Yield Pt.	30,000

THE NEW AGE

By C. A. WRAGG

THE statement that this is a new age is so often heard that it has perhaps become hackneyed. In view of the prevailing conception of the universe as a growing organism it may be said that every day is the beginning of a new age. But it is interesting to observe how the human spirit is slowly yet surely extending itself—as from a center along every radius of activity—discovering natural laws, and irresistibly demonstrating, in physics, mechanics,—in every science and art, its ever widening control over the phenomenon called matter.

In the course of time this mastery has risen high in one field, then in another. We have evidence of ancient Greek art in sculpture which has not been surpassed. The Roman power of reasoning applied in law is the basis of all modern methods of dispensing justice. And it is not known to what extent the still more ancient races had mastered the science of astronomy and of the effect of the changing relations of the astral bodies on the earth and its inhabitants.

From the beginning each outburst of power has in its turn slumbered, only partly awakening perhaps centuries later to stir fitfully in a different field from that of the previous awakening; and the succeeding eras, denoted by the terms Stone Age, Bronze, Iron, Steam, etc., may be considered as chapters in the history of man, each one indicating the substance or discovery by means of which the races of the period lifted themselves to a higher state of civilization and accomplished the greatest amount of self expression.

The present epoch is so rich in discovery, and the factors which will determine its character are in such a state of flux, that it may be opportune to speculate for a moment on what the distinguishing adjective of this age is likely to be, and why, with a view to ascertaining whether the matter can be intentionally resolved. It might be called the Electrical Age, the Wireless, Mechanical, or Chemical Age, according to the viewpoint, as such great strides have been made in all of these fields. Yet, the criterion being that which will render the greatest service to man in his struggle for universal peace and happiness, it is considered by the writer that if it is to be given any specific term it should be called the Aerial Age.

The settlement of this question depends upon two conditions: 1st, the degree of skill required for production and use; 2nd, the quality of the reaction when used, that is, the influence on the minds of people. Now, a well-designed aeroplane is "a thing of beauty and a joy forever" to those with eyes to see; there is in it a thesis—a harmony of proportion. And it is correspondingly difficult to draw, that is, pictorially rather than by the mechanical presentation of the draftsman. Its production is an art and involves a careful coordination of the fundamentals of physics and mechanics. It depends so much on scientific construction for successful flight even when unburdened by the quality of commercial usefulness that unscientific production is virtually impossible. Mr. Ford proposes to revolutionize the railway locomotive principally by the scientific reduction of the size of parts; but a locomotive is statically supported by rails, and such a structural condition could never arise in aeroplane design because the aeroplane is dynamically supported at the expense of its own carrying capacity, which necessitates so much greater fineness at all times in the matter of securing maximum strength with the minimum of weight. There is a very narrow track between the treacherous waters of structural weakness on the one side, and the morass of reduced load-carrying power on the other. The laws governing the degree of inherent stability and controllability to be embodied in the design are equally if not more exacting. Aeronautical engineers and aviators in general see a new significance in the two bibical statements which refer to the straight and narrow way and to the difference between the quick and the dead!

To pass on to the second condition of the influence on the minds of people and the quality of the reaction: It should be realized that tremendous civilizing and wealth-producing forces are released by the full utilization of such a time-saving device as the aeroplane—forces which are subtle and hidden, but nevertheless as potent and active in their relation to national health, wealth, and strength as sunlight and air are to the body of the individual. It is well-nigh impossible to describe the net results of a nation thinking of transcontinental journeys in terms of hours instead of days.

It is also difficult to fully convey the beneficial effect and the great comfort of air traveling, with the consequent enlarged vista. When flight at great heights is experienced there are constructive influences which begin to work in the minds of people in spite of themselves, and often in a way that is hardly perceptible to the consciousness. They look from the new viewpoint at the highest structures on earth dwarfed into insignificance; they take in a whole city at a glance and look beyond at the farms, seemingly no distance away, the buildings like dolls' houses, the cattle almost invisible, and the trees and spaces combining to form a beautiful mosaic; they feel the faint soothing throb of the engines; they become quiet and meditative, and "the trials that infest the day, fold their tents like the Arabs, and as silently steal away." They experience what they may never have had before, sleeping or waking—what their medical advisers may have struggled in vain to give them—complete relaxation. The soul is elevated and rests in the assurance of a larger fellowship than has ever before existed on earth. Such conditions and viewpoint are perhaps the best that could be contrived for the germination of the ideas that lead to the unity of races and to individual and international peace.

Thus, as the degree of constructive use of aviation constitutes a phycho-physical barometer, it is gratifying to note that since the war aerial transportation is becoming a bona fide agency of commerce. Australia has a mail service operated by the Gevernment, and several large companies have been formed for commercial air transportation. All Europe is awakened to the value of civil aeronautics. The London-Paris Air Express is particularly successful, and in a recent competition in Germany men floated about for more than five minutes at constant altitude without an engine, in gliders having deeply cambered wings. by means of which they were able to utilize the principles of wheeling and velocity soaring, covering a distance of over two and a half miles and sometimes circling twice over the heads of the onlookers. Man has become in fact a true rival to the soaring birds such as the eagle, the albatross. the buzzards of India and other great kings of the air. In the United States there are many aircraft companies operating in the regular business of transportation and passenger carrying. Beside the well known uses of sightseeing and the very successful work of the Post Office in the carriage of mail, there are enough other uses to make their recital wearisome. It is reported that one of the latest companies to be formed for passenger work will soon be carrying passengers between Washington and New York at fares approximately that of the railway; the journey will be done in one-third of the time and with so much greater comfort as to be incomparable. Flying is so safe that it is recorded that during 1920 considerably more than fifteen million miles were flown, and many tons of freight carried, besides 225,000 passengers.

Yet it is obvious that hardly the fringe of the great sureties of aerial commerce has been scratched. It can almost be said that the World War was the price paid for the establishment of aviation, which is not yet beyond its infancy. It was of course used as a destructive weapon, but it is written that every destruction is followed by a construction, and in order to justify the price paid it is surely incumbent upon us to infuse more activity into the *commercial* aerial program. The potential capacity and power of the United States in this respect are awe-inspiring, and the fact that we are so far comparatively inhibited is regrettable and inexcusable. The industry probably feels that it is determined by Congressional action, or rather, inaction; Congress may think that it should depend upon the initiative of the public; whereas, the fact is that all three should feel that urge of enlightenment and progress of which the flying machine is merely a concrete expression—a symbol, and cooperate to the limit. Let there be a Department of Civil Aeronautics under a single civilian head having piloting experience, with power to leave no stone unturned, literally as well as figuratively, in the laying out of numerous fields on every proposed highway; let the fundamental problems of the rights of way and of licensing machines and pilots once be definitely resolved, then bankers will open their coffers, the public will as a result quickly become familiarized with the sturdy practicability of aerial transport, and the industry can be relied upon to supply the finest machines. There is no doubt that any man who could be considered for the job would in the nature of things have sufficient imagination to be fired with a zeal for aerial possibilities that, whatever mistakes were made, would redound more to the interests of progress than the present indefiniteness.

Commercial aerial progress is inevitable. It is simply a question of whether a nation shall be positive, marching in the vanguard, exercising its full capacity like a real vertebrate, or, by lack of vision and true perspective, so dilly-dally as to bring about the negative condition of being ignominiously kicked into—the Aerial Age.

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

Alabama

The southern part of state, south of a line running east and west through MONTGOMERY, for the most part level, open country and many large fields. Good flying country, although very muddy in wet weather.

The southeast corner of state, although there are many large open fields, a great many of them have not been stumped. North of a line running east and west of MONTGOMERY the country gets rough. Much timber and only few open fields. Very mountainous around BIRMINGHAM district, very few open fields.

From MONTGOMERY, ALA., to SHELLMAN, GA., flat country, plenty of emergency fields.

From MONTGOMERY to DEMOPOLIS, MISS., via SELMA, UNIONTOWN. To Selma, timber strips, chop hills near Montgomery, to level near Selma, river and more timber. Safe at 3,500 feet. To Uniontown, safe 2,500 feet, farm patches, timber strips, thence to DEMOPOLIS, safe 3,500 feet, more timber (the same applies to Dempolis to Meridian, only more timber Meridian, and Meridian to Vicksburg, only hilly and rough with timber upon coming within twenty miles Vicksburg, Miss.).

MONTGOMERY to COLUMBUS, timber, bad. Air all this section good. MONTGOMERY to BIRMINGHAM, same as Columbus, only gets rough and hillier, especially on trip made via Montvallo, out of road.

Alabama is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done over this country, although swamp land is extended over a great deal of territory.

Alabama is open but very marshy along the water—appears to be floating bog, 3 to 4 miles back from water is woods and no chance. One could work from New Orleans to Mobile quite safely by following the Gulf—no beaches here.

Arkansas

TEXARKANA to LITTLE ROCK, timber, leveler near Texarkana than approaching Little Rock, which is rolling, with less timber, not many landing places in Little Rock section.

LITTLE ROCK to LONOKE, timber, few landing places. LONOKE to ENGLAND, safe altitude 2,500 feet, oil bumps, slightly rolling, timber patches. Air extra good. LONOKE to STUTTGARDE, the same, more timber, leveler. LONOKE to MEMPHIS, as above first forty miles, more timber, then country gets hillier, fewer landing places, some places none. Then upon approaching Memphis less timber, few farms, country fairly rough.

Arkansas is very bad. Swamps and rice fields, which are always dangerous landing places in the eastern and southern part, and the Ozark Mountains in the west and north are none too good.

Arkansas is very hilly.

California

Southern California (around San Diego), open country, ground clear, plenty of good landing fields.

At present there are only two well-established routes in Cailfornia: The San Francisco-Reno line and the San Francisco-Los Angeles-San Diego line.

Most of California is good. In making cross-country trips in this state one need only to follow the valleys to have good landing fields. Only a few mountains need be crossed to reach any point in the state.

There are two or three ways a plane could go from CRESCENT CITY to SACRAMENTO, CAL., and there are none of them that have too many places to land. The best route is:

Leaving Crescent City, follow the coast south to EUREKA (104 miles by road). At low tide it would be possible to make a forced landing most any place on the beach except two places, one about fifteen miles long and one about ten miles, and there are a few scattering fields on the way, then east across the Coast Range to REDDING or RED BLUFF (164 miles by road) very few landing places en route, and those where a forced landing could be made very undesirable, then south down the Sacramento Valley to Sacramento, where one could land most any time with safety.

The territory between STOCKTON and SACRAMENTO, SAN FRANCISCO and FRESNO: From Stockton as far north as MARYSVILLE, by way of Sacramento, and as far south as Fresno, is the safest possible territory for a pilot to cover in cross-country work. Flying at an altitude of 2,000 feet, the pilot has under him possible forced landing places all the time—places where he could set his ship down with a dead motor without serious mishap. Land is generally flat, crops are hay, grain, alfalfa, untilled pasture. Where there are vineyards enough hay or alfalfa land is interspersed to give the pilot considerable security even at this low altitude. One can land at or near the following towns: Marysville, Auburn, Thornton, Lodi, Galt, Escalon, Tracy, Modesto, Manteca, Madera, Herndon and Fresno. MODESTO now has a municipal landing field. From ROSEVILLE northeast to AUBURN is dangerous country. Orchards and increasing mountains.

From STOCKTON west to SAN FRANCISCO or SANTA CLARA VALLEY the risk is somewhat greater, but flying at an altitude of 4,000 feet at the rate of 70 miles per hour it has been noted that there are just minutes when one would have to choose foothills, unpretentious mountains or peat land in case of a necessary dead stick landing. In regard to the "Delta Region" along the SAN JOAQUIN RIVER on the west side of the valley the soil here is good to land on in the later summer and fall, when the crops have been taken off. At all other times one is sure to nose over, as the soil is very loose and practically without bottom. There is, however, a permanent landing field now near THORNTON, of this peat soil, and by allowing it to pack, it is good the year round. The mountains between Stockton (or the San Joaquin Valley) and San Francisco are not high and there are numerous places in them where one could land with comparative safety.

There is a very safe civilian field in the SAN JOAQUIN VALLEY. It is completely surrounded by open territory, hay and alfalfa fields, and there is not a moment during an ordinary passenger flight when a forced landing could not be made without injury to passenger or pilot.

Fields around Los Angeles are:

1. Goodyear Field, located at Florence and Central Avenues, and Manchester and South Park Avenues. Very good condition. No aeroplane hangars there as yet, but Blimp hangar is located on west side of field. Field when fully completed will be one mile long and one-half mile wide.

2. Rogers Airport, located at Wilshire Avenue and Crescent Boulevard. Formerly known as Syd Chapman Airdrome. Good size field, about 8 or 9 hangars, and probably best known field here. Thoroughly progressive in every respect under management of Emory Rogers, Webster and Halliday.

3. Mercury Aviation Field, opposite Rogers Airport, about same size as Rogers, but not as well equipped with hangars.

4. Kinner Airport, located Long Beach Boulevard and Tweedy Road, good field and runway east and west, one hangar capable of holding three planes.

5. White Airport, located at South Los Angeles, Tweedy Road, good field and runway east and west, one hangar capable of holding three planes.

6. De Lay Field at Venice, large and has one big hangar capable of holding about six aeroplanes, located back from ocean about half a mile. Used extensively as test field.

7. Sierra Field, Pasadena, good location.

8. Pacific Field, located on Pico Boulevard near La Brea Avenue. Field has one hangar capable of holding two planes, and is large.

9. Daugherty Field, located at Long Beach, recently dedicated as Municipal Field and used in midwinter air tournament. This is without doubt best located field with view to future out here. Has big runway and northwest end runs into drainage canal, which later by dredging can be made into fine hydroplane landing canal.

10. Lattimer Field at Ontario, Cal., is long and narrow, being located between tracks of S. P. and Santa Fe Railways. Has ample runway to east and west, but only 200 feet wide. (Accident occurred there recently, evidently due to wash of passing train, passenger killed and pilot badly injured.) The railway is evidently a menace to flying from this field, but careful pilots could avoid menace of trains by proper flying rules.

11. San Bernardino Field, located opposite Urbita Springs Park, good take-off to west. This is about one-half way from San Bernardino to Colton. Only used occasionally. No hangars.

12. Redlands Field, class "A" field, being built by city. 1,800 x 1,800 feet, not used extensively as yet, but is rapidly being put in fine shape. Secretary Chamber of Commerce is live wire and backing it in fine shape.

13. Santa Ana, field in fair shape, about one-half mile south of city.

14. Corona, has fair field to south and east of city.

15. Pomona, field about a mile south from city, planted to alfalfa, only used occasionally, but has fine take-off and country is flat in that direction.

16. Torrence, Cal., has field to east of city south of main boulevard, has take-off to south, landings cross wind. Danger of over-shooting field, however, has been used a number of times. About quarter of mile from city.

17. Redondo Field, on main boulevard, just south of Catalina Street, Pacific Aero Club used it some last year, field needs fixing up, is too sandy, and there is hazard of trolley line to west toward ocean. City has promised to fix it up this winter.

18. El Monte, has field just south of city, used occasionally. The Blue Bird Air lines have also operated at San Fernando, Axusa, Acton and Hemet.

19. Hemet Field, located on main boulevard about quarter of mile from city. Very good. Altitude about 1,800.

20. Newport, field is known as Townsend Field, and was used by naval fliers last summer. It is on main boulevard from Santa Ana, about five miles out of Newport.

As to the nature of the country, from Los Angeles to El Monte to Pomona to Ontario to San Bernardino to Redlands, is over flat country, an dthere are plenty of emergency fields at all points for forced landings. This is also true in flying west or south from Los Angeles. At Venice and Redondo, also at Newport and Balboa, the beach is always within reach for forced landings, and at low tide landings have been made on the beach at a number of places. This is also true of Long Beach. As one goes north from Los Angeles he has flat country as far as San Fernando and Sagus, the mountainous.

There is very little swampy land around Los Angeles, some south of Long Beach, and some south of Venice, but otherwise none that would amount to anything.

The physical hazards here are less than in any other part of the country.

Colorado

TRINIDAD to ELK CITY, OKLA., about the same, more farms and leveler on approach to Oklahoma line. TRINIDAD to PUEBLO, pretty rough, mountains north and west, some very bad places. PUEBLO to COLORADO SPRINGS, some very bad. High altitude, air light, mountains rough most of way, especially CRIPPLE CREEK section, west and east. COLORADO SPRINGS to DENVER, better, still rough.

Between COLORADO SPRINGS, COL., and CHEYENNE, WYO., a short flight of only two hours, is over flat country, with the exception of only a small range near Colorado Springs. All the territory east of DENVER is flat, and west of Denver mountainous, where landings might be made but with some difficulty.

The geographic condition of this part of the country is divided into two distinct districts: First—That part lying east of a line drawn through DENVER, COLORADO SPRINGS, PUEBLO and TRINIDAD. This country is practically one large landing field—rolling prairie, the greater part of it never having been broken, and the fences are few and far between. Second—To the west, however, there is mountain flying entirely, and while there are many parks and open places where it would be possible to land a ship in an emergency without very much damage, yet on the whole it is rather hazardous flying.

Connecticut

BRIDGEPORT, country around here is fair.

In the CONNECTICUT VALLEY REGION there are numerous good landing fields; country is very good on the whole.

From BRIDGEPORT up the Housatonic and Naugatuck Rivers to WATERBURY it is very poor flying country, fields being mostly on side hills and this is a very hilly and wooded country. In and around Waterbury it is very poor flying country—hills, small fields and woods. Slow landing planes may get in and out of some of these fields with skillful pilots. It is very difficult to find fields surrounded by other fields—a condition so much desired by pilots in case a motor quits on a take-off. To the east of Waterbury lies a valley formed by the Connecticut River from NEW HAVEN north. There are plenty of fair-sized level fields through here, around Meriden, Bristol, New Britain and Hartford.

From FRAMINGHAM, MASS., to Connecticut the country is rough and many woods cover the ground, along the Sound and Connecticut there are very many landing fields where a Jenny could land, and possibly a D.H.-4.

There are several possible landing fields in MIDDLETOWN, but not being along any flying route, this information is of little value.

From ROOSEVELT FIELD, N. Y., to DANBURY, CONN., across Long Island is good. Across the bay to NORWALK, CONN., and thence to Danbury, rather poor chance. Vicinity of Danbury rather bad and lots of hills.

From SPRINGFIELD, MASS., to BRISTOL, CONN., fairly good and excellent field there, but on proceeding to Danbury conditions become not so good, and hills increase.

Cuba

From HAVANA to SANTIAGO DE CUBA and GUANAMO the country is fairly good to fly over. There are any number of cane fields in which to land safely, but would necessitate dismantling the machine. There are many sugar mills scattered over the island and they all have some kind of a pasture that makes it easy to land.

Landing fields at the different towns of importance are:

Havana, Camp Columbia, military field nine miles southwest of town.

Cienfuegos, one mile northeast of town.

Camaguay, one-half mile northeast of town, U. S. Marine Field.

Santiago de Cuba, on water front west of town, only good in dry weather.

Guantanamo, one mile southwest of town near large hospital.

There are several other towns with fair landing fields, but they need fixing up a little. The ones named are in good shape and are taken care of, so they can be used any time, except the one at Santiago and a little rain will make a bog hole of it.

Florida

All bad country, except possibly central part or southern, near CARLSTROM FIELD. Good around ORMONDE BEACH.

Between SAVANNAH, GA., and JACKSONVILLE, FLA., it is all swamp land, extending inland 10 to 25 miles.

Florida (around Arcadia), both open and wooded country. Open country covered with palmetto bushes.

Florida, north of the EVERGLADES and FORT MYERS is safe for cross-country work. Landing fields are not abundant, but there are enough in case of trouble.

Florida makes a safe place for water planes. This does not include over ocean trips for long distances.

Georgia

Southern half of state level, open country. Many large open fields. Northwestern part of state, very few landing fields. Fields are terraced and are not stumped, making safe landing in case of motor trouble impossible.

Between SAVANNAH and JACKSONVILLE, FLA., swamp land extending inland 10 to 25 miles. From SAVANNAH north toward COLUMBIA, S. C., there is much marsh land and timber.

From SHELLMAN to AMERICUS, flat country, plenty emergency landing fields. Getting hilly toward MACON.

AMERICUS to MACON, landing possible anywhere from 3,000 feet. MACON to MADISON, few good fields on account of hilly country and terraces. Forced landing should be made between MACON and MADISON in dry weather. Between MADISON and ATHENS, very few fields (35 miles), good field ATHENS. ATHENS to AUGUSTA, practically no fields this strip, very bad hilly country. Good fields vicinity AUGUSTA.

AUGUSTA to COLUMBIA, S. C., no fields first 15 miles, good country last 60 miles. Good fields COLUMBIA.

ATHENS to ELBERTON, good emergency landings possible, hard to get away from on account soft land. ELBERTON to WASHINGTON, D. C., few fields except around TIGNALL.

WASHINGTON to ATHENS, practically no suitable fields. ATHENS to MONROE, good fields except in immediate vicinity around OCONEE RIVER.

ATHENS to ATLANTA, good landings first 20 miles, rest of route very bad, no possible chance to land except on field at ATLANTA, which is very bad. ATHENS to CARNESVILLE, no possible fields, hilly, awful country. ATHENS to SOCIAL CIRCLE, good fields all the way, good field at SOCIAL CIRCLE. SOCIAL CIRCLE to COVINGTON, not good country, but landings possible.

ATHENS to EATONTON, not good country, but landings possible. ATHENS to COMER, good fields in river pasture all the way. AUGUSTA to WARRENTON, landings possible all the way, cotton fields. AUGUSTA to LOUSVILLE, GA., good fields (cotton) large field LOUISVILLE. AUGUSTA to GREENVILLE, S. C., good fields to GREENSBORO, from there on country gets worse and is bad at GREENVILLE. No chance forced landings. From AUGUSTA to WAYNESBORO, good country all the way, flat.

Georgia is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash-up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

At SHELDON the land is flat and dry and landing fields are plentiful.

Illinois

Illinois (along Air Mail Route)—Flat country, but mostly given up to farming. Fields large enough but mostly plowed. Pastures usually the roughest land.

Central part of Illinois, radius 150 miles from CHICAGO, good.

The territory in the State of Illinois shows landing fields frequently, and very fertile for the aviation industry. The conditions prevailing here are excellent for flying.

The central portion of Illinois is practically all level country and would be termed good flying territory.

The route CLEVELAND-CHICAGO, of course, is very good, as it would be possible to pick a safe landing place at any time—the route is easy to follow and the mail has a good two-way field about half way. Martin Field at Cleveland is very good for any machine. The entire route CHICAGO-OMAHA is perfect for forced landings. Landmarks are good. The air mail has a fine field at IOWA CITY, IA., there is also a fine landing field on the north side of DES MOINES. The country from ATLANTIC, IA., to OMAHA is a bit rough, but from a reasonable altitude a landing could be picked without trouble. That is the regular mail route, but one could also follow the Burlington R.R.—CHICAGO to OMAHA. As far as the Mississippi River the country is perfect for landing, but from there until the Des Moines River is reached at OTTUMWA the country is rather bad, but with plenty of altitude a safe landing would be possible. From OTTUMWA the rest of the route is perfect.

All of Northern Illinois is excellent. CHICAGO to INDIANAPOLIS, IND., is good.

On the CHICAGO-CLEVELAND route, passing over BRYAN, OHIO, the land east from the Illinois line to a point ten miles east of GARY, IND., is swampy or with a scrub growth or sand dunes, unless swinging around more than five miles south of Lake Michigan. In the balance of the route over Indiana there are short stretches of territory of probably not over ten per cent of the distance altogether, on which a dead stick landing without damage would be difficult, but not impossible, due to rolling terrain and numerous groves. In OHIO, in the immediate vicinity of the MAUMEE RIVER, there is quite wet and soft ground during the rainy season. Within a radius of five miles of city limits of CLEVELAND the ground is quite difficult and fields very small. The weather across Indiana over the lakes region in particular is quite difficult during rainy seasons, but very rarely impassable, while the weather in OHIO has never been found impassable.

From CHICAGO to ST. PAUL, the ground is very smooth, ideal as regards flying, only scattered groves, but with the Mississippi Valley soft during wet seasons. This country is subject to heavy rain storms with low fog and clouds at times, but only rarely impassable.

From CHICAGO to OMAHA, over IOWA CITY, IA., the ground is very level with the exception of some very short distances in the vicinity of the Mississippi and Missouri Rivers. This country is subject to heavy rain storms with low fog and occasionally blinding snow storms and very cold weather in winter, but rarely impassable from these.

From CHICAGO to MINNEAPOLIS-ST. PAUL, over LA CROSSE, WIS., the route lies over fairly level and open territory as far as the Wisconsin River, from there on northwest the country grows rapidly rougher and with heavy timber till the last fifty miles out of La Crosse has only scattered possible landing fields. From La Crosse up the river valley or over the highlands to the west of river, possible landing fields are available from an altitude of two to three thousand feet. The territory from the Wisconsin River northwest has days when low fog and rain make it impassable, but these days are actually not numerous. In winter time this route suffers from very cold weather and blinding snow storms, but some of which are practically impassable.

None of these four routes mentioned suffer from prohibitive winds.

The route between MILWAUKEE and CHICAGO is almost ideal from an emergency landing field point of view. One route from MILWAUKEE to CHICAGO follows the C. M. & St. P. R. R. as far as RACINE, which is passed two miles west of the City Hall, KENOSHA is passed 2½ miles and WAUKEGAN 3 miles. Land at the Air Mail Field at MALWOOD, also known as the Checkerboard Field. All along the route there are many level fields which have ample landing facilities.

The best description of the territory about PEORIA could be described by saying that it is the center of the famous Corn Belt of Illinois. Within a radius of 150 miles any pilot with any reasonable amount of experience could pick an easy landing. Between PEORIA and GALESBURG the ground is flat. At GALESBURG the Caldwell Brothers have their field, where they conduct a school and do exhibition flying. Territory around CANTON, ILL. is O. K., likewise around BLOOMINGTON the landing places can be easily picked out. At PEORIA the Illinois River Valley is about two miles wide. Good landing fields can be found on either side. The width of the river here affords unusual facilities for flying boats and was used a great deal for this purpose last year. The AIRCRAFT CLUB here has recently leased a field which will be marked as called for by regulations and suitable hangar is being built. Visiting planes are welcome at any time.

Illinois is all good, except country from Franklin Co., south, including Johnson, Williamson, Union, Jackson Counties, which are very bad and dangerous to cross. In the N. W. corner in Jo Dowiers Co., it is very hilly and bad. The Air Mail Field at CHICAGO can be found—near the Station of Maywood—near big race track, north of drainage canal and along Desplaines River. Also near big cemetery—very good. Curtiss field—south of draining canal in big swamp—likely looking field.

NAVAL and MILITARY AERONAUTICS

Goodyear Airships Tested

The first test flight of the Army Airship No. A S 1504 was made at the Goodyear Akron Air Station September 12, by Flight Officer Lieut. G. W. McEntire. This airship is of the Goodyear Pony Blimp, or "AA," type. It has a gas capacity of 35,000 cubic feet, is 95.5 feet long, and has a maximum diameter of 28 feet. The car accommodates two or three passengers and is equipped with a Lawrence three-cylinder 50 HP motor, having a cruising radius of 450 miles.

This ship was manufactured by The Goodyear Tire and Rubber Company and assembled at the Goodyear Akron Air Station. It was flown by Lieut. McEntire to Dayton, Ohio, on September 19th, where it will be used by the Engineering Section of the Balloon and Airship Division for experimental purposes. A fabric hangar has been erected at Dayton to house the ship.

Fleet Air Force Gunnery

The Fleet Air Force on Sept. 2 commenced the annual gunnery exercises, consisting of eight practices per man for all pilots and men attached to the land plane divisions. Ground strips, towing sleeves and camera gunnery were included in the evolutions being carried out by the planes. Practices are expected to last until the latter part of October.

Immediately following the present practices the seaplane divisions will start the annual bombing practices, dropping live and dummy bombs at fixed and towed targets. It is thought these practices will last approximately one month.

Army Uniforms Not to be Materially Changed

Inquiries having reached the War Department as to whether or not there would be a return to the blue uniform, the War Department authorizes the statement that there is no present intention of making material changes in the existing uniform or additions thereto. Under existing regulations the blue uniform has been abolished; and the white and olive-drab uniforms being those authorized.

Minor changes authorizing a slit in the bottom of coat skirt and a hook on the coat to hold the Sam Browne Belt in place are in course of preparation.

Love Field Accident

Love Field, Dallas — Three aviators were killed in an accident here Sept. 16. James F. Armstrong was one of the men. The other two were named White and Gibson.

The plane went into a tail spin and the three men were burned to death. Armstrong was a lieutenant. White and Gibson were mechanics. They were from Fort Sill, Oklahoma.

Advises Air Force at the Philippines

London—Vice-Admiral Mark Kerr, in an article in the London *Outlook*, declares that the United States needs no huge

(*Continued on page* 111)

Reorganization of the Air Service at Reduced Strength

Orders are being issued by the War Department as follows:

1. That the following units be organized at the stations indicated:

Unit	*Place of Organization*	*Table*	*Permanent Station*
15th Squadron (Observation) (Reduced strength)	Chanute Field	873	Chanute Field
16th Squadron (Observation) (Reduced strength)	Fort Riley	873	Fort Riley
18th Squadron (Observation) (Reduced strength)	Rockwell Field	873	Rockwell Field
19th Squadron (Pursuit)	March Field	277	Oahu
23rd Squadron (Bomb'm't)	March Field	576	Oahu
24th Squadron (Pursuit)	Mitchel Field	277	Panama
25th Squadron (Bomb'm't)	Mitchel Field	576	Panama
26th Squadron (Attack)	Kelly Field	279	Kelly Field
28th Squadron (Bomb'm't)	Mather Field	576	Philippine Islands
Photo Section No. 3	Bolling Field	79	Bolling Field
Photo Section No. 5	Chanute Field	79	Chanute Field
Photo Section No. 8	Mitchel Field	79	Mitchel Field
Photo Section No. 9	Fort Riley	79	Fort Riley
Air Park No. 3	Langley Field	175	Langley Field
Air Park No. 6	Mitchel Field	175	Mitchel Field
Air Park No. 7	Mitchel Field	175	Mitchel Field
Air Park No. 8	Mitchel Field	175	Panama
Hdqrs. 1st Balloon Group	Brooks Field	177	Brooks Field
Gunnery Det. (See Note 24)	Carlstrom Field		Carlstrom Field
Branch Intelligence Office 11	Oahu	71	Oahu
Branch Intelligence Office 12	Philippine Islands	71	Philippine Islands
Branch Intelligence Office 10	Panama	71	Panama
Branch Intelligence Office 1	Mitchel Field	71	Mitchel Field
Branch Intelligence Office 2	Kelly Field	71	Kelly Field
Branch Intelligence Office 3	Crissy Field	71	Crissy Field
Det. Office, Chief of A. S.	O. C. A. S.		Washington

2. That when accommodations are available in overseas departments for units that are to be organized in the United States under paragraph 1 above, the Department Commander concerned will request orders for their transfer. The Commanding General, Panama Department, will make similar request when quarters are available for two balloon companies not mentioned above.

3. That the following units be demobilized:

Heavier-than-Air Det.	Camp Knox
Heavier-than-Air Det.	Camp Benning
Pilot School	March Field
Supply Detachment No. 1	Fairfield, Ohio
Supply Detachment No. 2	Fairfield, Ohio
Supply Detachment	Mather Field
" "	Mitchel Field
" "	Rockwell Field
" "	McCook Field
" "	Love Field
" "	Park Field
" "	Scott Field
" "	Souther Field
" "	Middletown, Pa.
Casula Detachment	Crissy Field
Stockkeepers School Det.	Fairfield, Ohio

4. That the following units be placed on the "Inactive List" under the provisions of Section II, G. O., No. 32, W. D. 1921, with "Active Associates" as indicated:

Inactive Associate	*Active Associate*
Balloon Co. No. 6	Balloon Co. No. 23
" 7	" 23
" 11	" 23
" 14	" 1
" 15	" 13
" 24	" 1
" 25	" 13
" 26	" 20
" 28	" 22
" 29	" 20
" 30	" 22
" 31	" 20
" 32	" 22
Headquarters, 2nd Wing	Headquarters, 1st Wing
Headquarters, 7th Group (Observation)	Headquarters, 1st Group

5. That the following named units be redesignated and reorganized where necessary in accordance with the 1920-21, Tables of Organization:

Old Designation	*New Designation*	*Table*	*Station*
1st Squadron (Observation)	1st Squadron (Obs.) (Reduced strength)	873	Mitchel Field
3d Squadron (Observation)	3rd Squadron (Pursuit)	877	Philippine Is.
5th Squadron (Observation)	5th Squadron (Obs.) (Reduced strength)	873	Mitchel Field
6th Squadron (Observation)	6th Squadron (Pursuit)	277	Oahu
8th Squadron (Surveillance)	8th Squadron (Attack)	279	Kelly Field
10th Squadron (Observation)	Air Park No. 1	175	Bolling Field
12th Squadron (Observation)	12th Squadron (Obs.) (Reduced strength)	873	Kelly Field
13th Squadron (Observation)	13th Squadron (Attack)	279	Kelly Field
50th Squadron (Observation)	22nd Squadron (Obs.) (Reduced strength)	873	Post Field
22nd Squadron (Observation)	50th Squadron (Obs.) (Reduced strength)	873	Langley Field
88th Squadron (Observation)	88th Squadron (Obs.) (Reduced strength)	873	Langley Field
90th Squadron (Surveillance)	90th Squadron (Attack)	279	Kelly Field
91st Squadron (Observation)	91st Squadron (Obs.) (Reduced strength)	873	Eugene, Oregon
99th Squadron (Observation)	99th Squadron (Obs.) (Reduced strength)	873	Bolling Field
Balloon Company No. 2	Balloon School	780	Ross Field
" " No. 3	Balloon Company (Coast Def.) No. 3	579	Oahu
" " No. 4	Balloon Company (Coast Def.) No. 4	579	Brooks Field
" " No. 5	Balloon Company (Coast Def.) No. 5	579	Brooks Field
" " No. 9	Airship Co. No. 9	580	Ft. Omaha
" " No. 12	Airship Co. No. 12	580	Ft. Omaha
" " No. 17	Balloon Company (Coast Def.) No. 17	579	Philippine Is.
" " No. 18	Airship No. 18	580	Aberdeen
" " No. 20	Balloon Company (Coast Def.) No. 20	579	Lee Hall
" " No. 21	Balloon Company (Coast Def.) No. 21	579	Oahu
" " No. 22	Balloon Company (Coast Def.) No. 22		Lee Hall
" " No. 27	Balloon Company (Coast Def.) No. 27	579	Philippine Is.
Airship Co. No. 10	Airship School		Langley Field
Headquarters, 1st Surveillance Group	Headquarters 3rd Group (Attack)	274	Kelly Field

6. That the following units or detachments be transferred as indicated, the change of station to be made by rail, marching, trucks or aeroplanes, depending upon which means is the cheapest, the commander concerned making the decision:

Unit or Detachment (*See Note* 1)	*Approx. Strength*	*From*	*To*
Airship No. 8	57	Camp Bierne	Brooks Field
91st Sqdn. (Obs.) (Red. strength) (See Note No. 2)	105	Mather Field	Crissy Field
2nd Group Bombardment) (See Note 3)	386	Kelly Field	Ellington Field
49th Squadron (Bombardment) Upon completion of present duty	128	Langley Field	Langley Field
96th Squadron (Bombardment) Upon completion of present duty			
Headquarters First Wing	12	Kelly Field	Kelly Field
Flight "B" 8th Sqdn. (Attack)	Name only	Camp Bragg	Kelly Field
Headquarters and Flight "A," 12th Squadron (Obs.) (Reduced strength) (See Note 4)	24	Douglas	Kelly Field
Flight "B" 12th Sqdn. (Obs.) (Reduced strength) (See Note 4)	25	Nogales	Kelly Field
88th Sqdn. Obs. (Reduced strength)	Name only	Langley Field	Camp Knox
Photo Section No. 7	Name only	Langley Field	Camp Knox
1st Sqdn. Obs. (Reduced strength) Upon completion of present duty	43	Langley Field	Mitchel Field
5th Sqdn. (Obs.) (Reduced strength) Upon completion of present duty	44	Langley Field	Mitchel Field
22d Sqdn. (Obs.) (Reduced strength)	Name only	Post Field	Montgomery
Photo Section No. 4	Name only	Post Field	Montgomery
Airship Co. No. 9	25	Omaha	Scott Field
Airship Co. No. 12	31	Omaha	Scott Field
Detachment	17	Ft. Baker	Ross Field
" (See Note 5)	20	Camp Lewis	Scott Field
"	68	Camp Lewis	Crissy Field
"	19	Eugene, Ore	Crissy Field
" (See Note 6)	50	Camp Benning	Lee Hall
"	46	Ft. Baker	Crissy Field
" (See Note 7)	56	Camp Benning	Montgomery
"	4	Park Field	Montgomery
"	26	Southern Field	Montgomery

(*Continued on page* 118)

(*Continued from page* 110)

battle fleet to defend the Philippine Islands because it can be better accomplished by use of air patrols in collaboration with destroyers, submarine chasers, motor boats and underwater defense craft.

His main contention is that the battle fleets cannot operate to advantage when so far removed from their home bases. He says further that in conversation with Admiral Sims he found the American Admiral in agreement with him on the future methods of naval warfare. With such a defense as he suggests, Admiral Kerr says of the Philippine problem:

"Mine fields and mine nets complete the equipment for preserving the sacredness of the sanctuary around the Philippines, a sanctuary which it will practically be suicide for an enemy to enter."

Petty Officers' Club

At a recent election held in the Aviation Chief Petty Officers' Club rooms at the Great Lakes Training Station, it was proposed to expand the club and to move it to the main station so that every chief on the station will be eligible for membership. Following the move, the club will be affiliated with the Chief Petty Officers' club that was recently organized on the Pacific coast.

The Late Capt. Minnis

Washington.—Captain John A Minnis of the Marine Corps was killed Sept. 22 while flying at the Marine Flying Field at Quantico, Va.

Captain Minnis was doing night flying to give practice to the Searchlight Battalion at the Quantico Marine Barracks. In VE-7 Aeroplane 5957, at an altitude of 3,000 feet, his machine was caught in a searchlight beam and Captain Minnis made a dive at a sharp angle to get away from it, a common practice. At an altitude of about 1,000 feet, Captain Minnis pulled out of the dive and observers got the impression that the plane from that time on was out of control. With the motor running, the plane struck water directly off the mouth of Quantico Creek. It is supposed that Captain Minnis used his motor in an effort to pull up the nose of the plane. His body was found in the wreckage of the plane.

Mrs. Laura W. Minnis, Captain Minnis's wife, was at the Quantico Hotel at the time of the tragedy, with her infant daughter. Captain Minnis's mother, Mrs. Maggie S. Minnis, resides at 211 Church Street, Montgomery, Ala.

Captain Minnis was born June 6, 1891, at Montgomery, Ala., was appointed to the United States Naval Academy in 1911 and upon graduation became a second lieutenant in the Marine Corps. He served in the World War with the Thirty-eighth Infantry and the Fifth Regiment of Marines. He was decorated with the Distinguished Service Cross for conspicuous bravery at Mesey on July 15, 1918, and was wounded in action on Sept. 15, 1918. He also received the Navy Cross.

Lt. Commander Douglas Married

Stamford. — Winifred Davis Moore, daughter of the late Mr. and Mrs. Samuel Todd Davis, Washington, was married to Lieutenant Commander Archibald Hugh Douglas, U. S. N., October 1, at the Caritas Island home of her sister, Mrs. J. Percy Bartram.

FOREIGN NEWS

The Next Paris Aero Show

It is now announced officially by La Chambre Syndicate des Industries Aéronautiques that the Seventh International Exhibition of Aerial Locomotion organized by this body will take place in Paris from November 12 to 27. No exhibition was held last year, owing to the depressed state of the aircraft industry. The fact that it has become possible to hold an exhibition this year indicates that the French aircraft industry is already on the upward path after the slump.

It is earnestly to be hoped that the British aircraft industry will be thoroughly well represented at the forthcoming exhibition. All foreign countries are now taking a lively interest in air transport, and, though actual orders may not be numerous in November next, those firms which have the courage to make a good display will, at any rate, have an opportunity of making a reputation for themselves which will have considerable influence on their order books in the following year. Paris is always the centre of any new movement, owing to its being so easy of access as compared with any other European capital, and also because it has no early closing laws.

All correspondence should be addressed to Monsieur le Commissaire Général de la Chambre Syndicale des Industries Aéronautiques, 9, Rue Anatole de la Forge, Paris 17e.

English Channel Statistics

An interesting comparison of crew and passenger personnel may be made in the statistics for the English Channel services for the week ending September 4, as follows: Machines, 103; passengers, 427; crews, 129; total personnel, 556. Corresponding week last year: Machines, 104; passengers, 219; crews, 129; total personnel, 348.

Air Line Developments in Czecho-Slovakia

Apparently Prague is making very appreciable progress as the center of a net-work of air transport services. There are already daily services linking Prague to Paris, Strasbourg, and Warsaw, and during the next few months it is believed that there will be services to Budapest, Belgrade, Bucharest and Constantinople, and to Dresden and Berlin.

In February last year when the Paris service started three passengers only arrived by air at Prague. In June the figure was 76. In February 16 lbs. of parcels and 3 lbs. of newspapers arrived by air. In June 7,000 lbs. of parcels and a ton and a half of newspapers were brought by air.

The figures of duty paid on goods arriving by air are instructive. They are: February 130 crowns, March 3,550 crowns, April 30,787 crowns, May 86,752 crowns, and June 207,104 crowns.

The Franco-Roumanian Air Navigation Company, who operate the Paris-Prague Service, have over 40 machines in service.

For the extension of the service to Constantinople a type of large multiple engine machine is being built at the Blériot works. This machine will, it is said, be of 1,200 h.p. and will have accommodation for 16 passengers and their luggage.

British Seaplane Dock Finished

The seaplane floating dock laid down in November, 1920, has now been finished. Built in Sheerness Dockyard, it has a length of 143 ft. over all, and a width of 51 ft., with a lifting capacity of about 200 tons. The dock should have ample accommodation for two of our largest modern seaplanes.

Good Work of an Avro

The Queensland and Northern Territory Aerial Services, Ltd., have in use an Avro biplane, fitted with a Sunbeam "Dyak" engine. This machine has now flown 7,400 miles in 111 hours with 285 passengers at a cost of 9 cents per mile. Good pioneer work that.

Canadian Licenses

The Canadian Air Board reports the following licenses in force on August 31, 1921: Private Air Pilots, 61; Commercial Air Pilots, 93; Air Engineers, 149; Air Navigators, 1; Civilian Aircraft, 59; Civil Government Aircraft, 30; Canadian Air Force, 59; Civil Air Harbor Licenses, 21.

Australian Air Mail

The government has asked for bids for a weekly air mail service between Sydney and Brisbane, Sydney and Adelaide, 540 and 795 miles respectively.

French Activities

The French military air service will have more than 40,000 aeroplanes next year if the Army Budget passes into law without serious alterations. The French Flying Corps would then have 286 regiments, each of 12 squadrons.

French aeroplane constructors are in a very strong position, mainly because the French Government, to help the industry, allowed the constructors to execute most of the outstanding war contracts. French constructors have on hand substantial orders from Japan and South America.

The first regular oversea airship service is now being organized by a French syndicate, to whom the French Government will make over airships and equipment. The service will be between Marseilles and Algiers, with a halting point, when required, on the Balearic Islands. The distance is 500 miles, and it is reckoned that the journey will be made comfortably in about eight or ten hours.

One of the airships to be used on this route is the Nordstern, the last to be built by the German Zeppelin works, which has been handed over to France by order of the Inter-Allied Commission, in replacement of airships which were destroyed in their sheds by German crews.—*From London Times, August* 19, 1921.

Particulars of three new metal aeroplanes which have been built at the Petit Creusot factories at Chalon-sur-Saone, are described in the Paris *Temps*. These aeroplanes—Henri Paul, B.4—are military machines designed for night raids, with a framework made entirely of metal (steel and duralumin).

They are biplanes with a lifting surface of 220 sq.m. (263 sq. yards), the wings being 30 m. (32.8 yards) from tip to tip. Their armament consists of twin machine-guns, fore and aft, with mobile guns, and their carrying capacity is 1,800 kg. (nearly 4,000 lbs.), in addition to enough petrol for a flight of five hours, which would give the machine a radius of 500 miles.

There are four motors of 350 horse-power; oil is contained in four reservoirs and petrol in four others, all isolated from the motors. The total weight of the aeroplane in flight is 9,000 kg. (2½ tons). Its speed at an altitude of 2,000 m. (6,500 ft.) is 100 miles an hour, and its minimum speed is 56 miles. The machine can rise to a height of 5,500 m. (18,000 ft.).

German Air Lines

According to a statement credited to Capt. Guest, head of the British Air Ministry, Germany now has ten commercial air lines in operation, as follows:

		Fare in Marks
(a)	Berlin to Danzig and Konisberg	975
(b)	Berlin to Bremen and Munster	650
(c)	Berlin to Bremen and Wangeroog	650
(d)	Berlin to Brunswick and Dortmund	800
(e)	Berlin to Dresden	500
(f)	Berlin to Leipzig, Nurnberg, Munich and Augsberg	1,725
(g)	Hamburg to Magdeburg, Leipzig, and Dresden	700
(h)	Munich to Constance	400
(i)	Stuttgart to Constance	450
(j)	Travemunde to Warnemunde, Sassnitz and Swinemunde	550

Some 6,000 miles are said to be flown daily.

Captain Guest also stated: "The German Government is unquestionably fostering civil aviation, which is, however, at the moment considerably handicapped by the restrictions on the construction of aircraft imposed by the Treaty of Versailles. There are in Germany two main bodies which virtually control all air traffic—the Deutsche Luftreederei and the Nord Deutsche Lloyd. The latter comprises some eight or ten companies—the most important of which are the Rumpler Albatross, Sablatnig, and Junker concerns. A large number of societies have been founded throughout the country with the object of stimulating interest in and promoting the development of aviation in all its civil aspects. The Government is indirectly represented on the 'Flug and Haven,' which is the most influential of these institutions."

Airship Base for Spain

A German commission is examining the Spanish coast from Huelva to the mouth of the Guadalquivir, with the object of establishing a large Zeppelin base for communication with South America.

The Germans, though their activities in matters aeronautical are restricted by the provisions of the Peace Treaty, have never lost their interest in aviation. Although they may not build, there is nothing to hinder them in making plans for the future.

London-Madrid Service

An irregular passenger service by air to Madrid is announced by the Lep Aerial Travel Bureau of London.

A large number of aeroplanes of various types are being delivered to Spain and advantage is being taken of the seats available to institute a passenger service.

The flight will be made in easy stages and will occupy approximately two days, but should the passengers' requirements necessitate greater speed, the flight will be made in one day.

At presnt twice-weekly departures are proposed.

New Zealand Favours Aviation

It is evident, from a recent statement made by Sir Heaton Rhodes, New Zealand Minister of Defence, that the New Zealand Air Board is justifying its existence. In outlining the work of the Air Board, Sir Heaton said that the Government had decided, after the matter had been thoroughly considered by the Air Board, to make provisions for the development of aviation along lines which would enable the Dominion to possess civil aviation for commercial and other needs, and at the same time to provide for the necessities for aerial defence in case of emergency.

The key of the system was the Air Board, which would advise the Government on all sides of the question. On the purely defence side the function of the Board would be to advise the Government as to the purchase, rent and preparation of key aerodromes; the purchase and maintenance of war aeroplanes; and the inspection by members of the defence staff of aviation schools and their equipment; the institution of refresher courses for ex-R.A.F. pilots, so that the valuable training of these men might not be lost to the country; and the allotment of defence machines to civil companies. The survey of routes would be undertaken by officers of the Aviation Branch of the Defence Department or by any competent aviator who might be deputed by the Board to undertake the work.

As defence aviation, owing to the great cost involved, could not be developed without the development of the commercial side, the Board was also entrusted with the duty of advising how this development could best be promoted. The general lines of the Board's duty in this respect was to advise as to: (1) Companies or private individuals that might be subsidised for the conveyance of mails and passengers on approved routes; (2) the allotment by way of loan or otherwise of Government machines; (3) inspection of privately-owned machines; (4) the reservation of rights of particular companies or individuals to fly for hire within prescribed areas. The Board would make recommendations as to contracts for passenger and mail services, and such contracts would be submitted to the Minister for Defence and also the Postmaster-General.

On general lines the Board would be an advisory authority with respect to legislation regarding aviation, and would also consider and recommend in what direction assistance should be given to the Meteorological Department, with a view to equipment to meet the needs of aviation.

ELEMENTARY AERONAUTICS and MODEL NOTES

Models Constructed By J. D. Bunch

SINCE 1917 Mr. J. Danner Bunch, of Vincennes, Indiana, has been an Aerial Age subscriber and a follower of the Elementary Aeronautics Page. The illustration below is a typical example of the recent work he has accomplished, and our readers may be interested in the description of its performances and some general notes on his activities as outlined in a recent letter to the Editor.

The compressed-air model of the tractor monoplane type has a wing spread of 54 inches and an overall length of 34 inches. The propeller is 14 inches in diameter; there is a clearance of 2 inches between the ground and the propeller blade. The best flight made with this model was 470 feet.

Concerning the trial flights, Mr. Bunch writes: "This model was flown from the top of a silo 60 feet high. A number of young men accompanied me to witness the flight. When we reached the silo it was found that the model was too large to be taken up through the inside chute, so it was necessary for one of the fellows to climb up and let a cord down on the outside. In this way the model was brought to the top, where with the aid of three assistants the tank was filled with air to a pressure of 130 pounds per square inch.

"The model was launched by hand with the wind. It climbed but very little and then settled down to straight flying. As it crossed over a barnyard an updraft caught it, making it zoom' steeply. This caused the machine to stall and dive, after which it flattened out again until the power gave out. It then settled into an easy glide and made a good landing in a stubble field. It rolled along the ground about 8 feet after the wheels touched. Upon examination it was discovered that in rolling on the ground the wheat stubble broke one of the flying wires.

"From the top of the silo, the buzzing of the motor could be heard for quite a distance. It could be heard quite plainly on the ground also. Two of the observers who were below the machine when it stalled said that as it zoomed they could hear the motor slow down and that when it went into the dive, the motor could be heard to 'tear out' again to full speed."

An attempt is to be made to take snapshot photographs of models from the silo roof.

A racing type rubber-driven model, recently completed, made a dozen flights, the best of which was 2750 feet, witnessed by a crowd of young men. This model was much admired and an offer of twenty dollars was received for it. The fuselage members were 1/8 inch by 7/16 inch, tapered down at the ends. The wings were of the double surfaced type, the main wing measuring 36 by 7 inches and the small front wing, 17 by 5 inches. Propellers 12 inches in diameter. From these figures it will be seen that Mr. Bunch believes in large wing area; in fact he attributes a good measure of his success to the use of plenty of supporting surface.

The type of machine which affords him the most pleasure in experimenting with, is the single propellered r. o. g. type, both pushers and tractors. A lately completed r. o. g. pusher with a 9 inch propeller was an excellent flyer, making pretty landings even in a stiff breeze. This particular model was traded to an aviator for a half hour ride in his aeroplane.

The next model to be built will be an r. o. g. tractor monoplane having the following specifications:

Wing spread	40	inches
Chord	5½	inches
Length	32	inches
Propeller, (one)	12	inches
Clearance between ground and propeller tip	2	inches

This model will have a high center of gravity, large wing surface and a propeller with low pitch. It is believed that better landings can be made with a model having a slow flying speed and shallow gliding angle. The propeller is to be one of the "toothpick" types somewhat like one shown on a German model biplane published some time ago. It is expected that good photographs of the finished machine will be available for publication in the near future.

Woods Used in Aircraft Construction

(Continued from Oct. 3 Issue)

Hickory

The greater part of hickory lumber is from the following species: shagbark, shellbark, pignut, mockernut, bitternut, water, nutmeg and pecan.

Wood of the first four species named above has been suggested as a possible substitute for ash in longerons since it is tough and strong, though heavier than ash. It is used to some extent for landing skids.

Sugar Maple

This species is also known as hard, rock and black maple. Sugar Maple, which is in many respects similar to beech, is used in the same manner as birch and beech, for propellers, etc. It is also used for engine bearers.

Oaks

The white oaks comprise the following varieties: white, post, bur, cow, overcup, and chestnut oak. The varieties of red oaks are: red, texan, pin, scarlet, yellow (or black) and willow oak. These twelve species furnish the greater part of the oak lumber cut in the United States.

The white oaks shrink and swell with the weather less than do the red oaks. They glue well, finish well and are very strong. The first four species mentioned have long been approved as propeller woods. For propellers, quarter-sawed material is much more superior to plain-sawed, because it shrinks less in a radial direction.

The red oaks are not used to any extent for propellers, though some of the northern species may be found satisfactory. There is considerable variation in the strength properties of red oak lumber, even of one species, and moreover it is more likely to be defective than white oak.

White oak of the four approved species has also been approved for structural and bent work on wings and fuselages.

Yellow Poplar

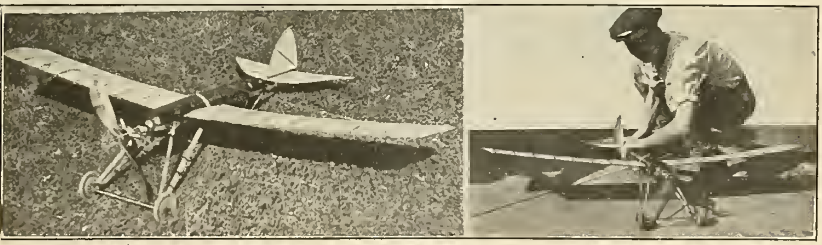
This species is also known as tulip poplar, tulip tree, white wood, and hickory poplar. Cucumber and evergreen magnolia have about the same strength properties as yellow poplar.

This is a very important wood for aircraft construction. It has been used with satisfactory results for most of the wood parts of an aeroplane. While it is a little heavier than spruce and has not as high shock resisting qualities, it is comparatively strong, retains its shape well and is easy to work. It has been used to some extent for propellers, particularly by the French. It makes excellent cores for ply wood and has been so utilized in considerable quantities.

Black Walnut

Black walnut makes the best propellers of any native species. It is easy to work, finishes well. is very resistant to wear and to shocks, and retains its shape remarkably well. It is likely that walnut will be an important wood for this purpose for some time.

(To be continued)



J. Danner Bunch and his 54 inch compressed-air monoplane. This model has flown a distance of 470 feet

A-E-R-O-N-I-T-I-S

Joy Riding

1
'Twas on a Friday morning
One 13th day of May
That John McGunn, bent on some fun,
In an "Aero" sailed away.

2
He'd left the field behind him,
With skill he held the stick,
He turned, he dipped, he looped that ship
Till those who watched felt sick.

3
He skimmed on by the hour
With many a stunt and bank;
He thought of the pleasure only
And not of his gasoline tank.

4
Yes, far from the drome he floated,
His eyes on the field below,
When the joyous roar was silenced
Anr his engine refused to go.

5
His hand jerked at the throttle,
He dove that ship like the deuce,
But his efforts to get it started
Were useless without juice.

6
Now a very sensible flyer
Was this Pilot John McGunn
And he knew a bad forced landing
Would probably end his fun.

7
So a smooth looking field he spotted,
Three thousand feet below,
And pushing his joy stick forward
He let that old ship go.

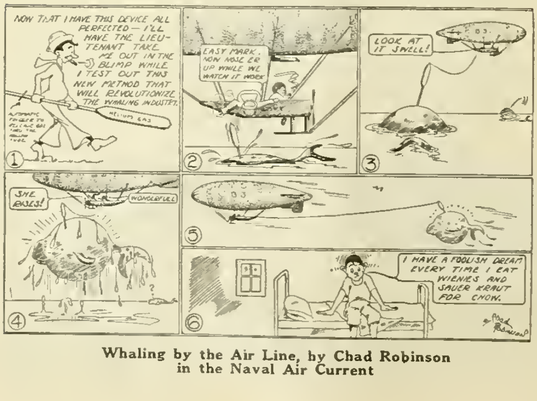
8
Not long did it take to land her,
Like a boulder dropped McGunn
Till he hit a stump with an awful bump
And tragically ended his fun.

—*"Spadite."*

Mary's Ankle

Mary bought a stylish skirt
Then grew a little taller;
So now what once was Mary's skirt
Is Mary's little collar.

—*Tennessee Tar.*


NOW THAT I HAVE THIS DEVICE ALL PERFECTED—I'LL HAVE THE LIEUTENANT TAKE ME OUT IN THE BLIMP WHILE I TEST OUT THIS NEW METHOD THAT WILL REVOLUTIONIZE THE WHALING INDUSTRY.
HELIUM GAS
1
EASY MARK. NOW NOSE ER UP WHILE WE WATCH IT WORK
2
LOOK AT IT SWELL!
B3
3
SHE RISES!
WONDERFUL!
?
4
B3
5
I HAVE A FOOLISH DREAM EVERY TIME I EAT WIENIES AND SAUER KRAUT FOR CHOW.
6
Chad Robinson

Whaling by the Air Line, by Chad Robinson in the Naval Air Current

Girls, Girls!

Headline in newspapers: "Girl carpenter drives nail like lightning." The meaning probably is she never hits twice in the same place.—*Buffalo Express.*

A Sporting Judge

"Thirty days in the workhouse. That ought to cure you of speeding."

"It certainly will, your honor. Would you like to use my car while I'm in durance vile?"

"No, thanks, I've seen you riding in that old bus of yours. It couldn't do over 18 miles an hour.

—*Birmingham Age-Herald.*

Confirmed Economists

"Yes, they are a very economical couple. They eloped to save themselves the cost of a wedding."

"Can't say that they look very happy."

"They're not, but they are living together to save the cost of a divorce." —*Foreign Service Magazine.*

Mr. Peck: "I want to take up boxing. My wife ——— ."

Instructor: "But you can't fight your wife."

Mr. Peck: "I know it. I'm not even going to try. What I want is to be able to stand punishment.—*Amer. Legion Weekly.*

That's Different

Willis: "Our company was getting 1,000 barrels a day when suddenly, on December 1, our production was stopped."

Gillis: "That's funny. I never heard of an oil well acting like that before."

Willis: "Who's talking about oil wells? This was a brewery."—*Judge.*

Never Saw a Campus

"How do you know that Perkins didn't go to college?"

"Why, he said he knew Babe Ruth when she was a chorus girl."—*Fort Mason Marking Pot.*

He Must Have Been a Man

Edith Wharton, the writer, told this war story: "The American wounded were being brought in from the second Marne battle," he said, "and a fussy American woman in a Khaki uniform and Sam Browne belt knelt over a stretcher and said, 'Is this case an officer or only a man?' The brawny corporal who stood beside the stretcher gave her a grim laugh and said: 'Well, lady, he ain't no officer, but he's been hit twice in the innards, both legs busted, he's got two bullets in both arms, and we dropt him three times without his lettin' out a squeak, so I guess ye can call him a man.' "—*Seattle Argus.*

So To Speak

One afternoon a stranger debarked from a train at a hustling town in the West and headed up the street. Finally he met a party that looked like a native.

"Pardon me," said the stranger, halting the likely looking party. "Are you a resident of this town?"

"Yes, sir," was the ready rejoinder of the other. "Been here something like fifty years. What can I do for you?"

"I am looking for a criminal lawyer," remarked the stranger. "Have you one here?"

"Well," reflectively answered the native, "we think we have, but we can't prove it on him."—*Chicago Herald.*

Nothing to Worry About

Passenger—"Say, does this car always make this noise?"

Driver—"No, only when it's running."—*Tennessee Mugwump.*

The Beast!

When they first met he said, "A bear."
He'd dog her footsteps anywhere.
She monkeyed with him for a year,
Although she said he was a deer.
A little horseplay hitched the two,
Now he's the goat. It's nothing gnu.

—*American Legion Weekly.*

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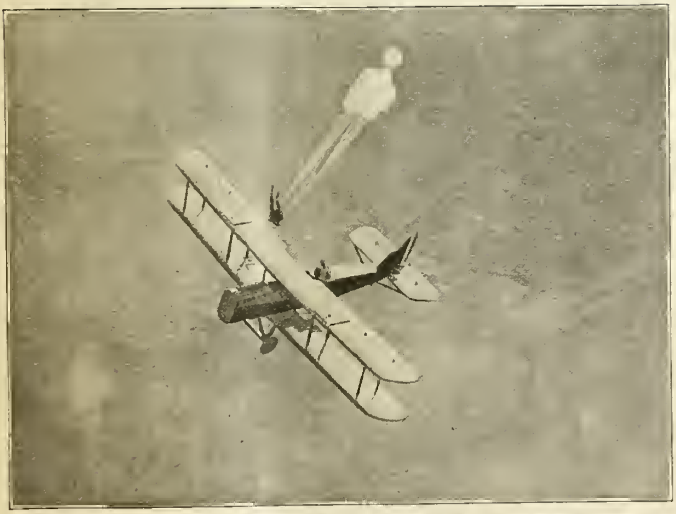

Actual photograph of Lieut. Hamilton being pulled off plane at Rantoul, Illinois, in recent tests with parachute just opening, showing the perfect operation of life pack

The Floyd Smith Life Pack

Used by the U. S. Army and Air Mail Service

The Parachute That Has NEVER FAILED

LIEUT. HAMILTON AND SERGT. SCHROEDER used this life pack in their record-breaking jump of 23,700 feet at Rantoul, Illinois.

PILOT C. C. (MIKE) EVERSOLE used this life pack in escaping from his wrecked mail plane at Mendota, Minnesota.

MAJOR R. W. SCHROEDER, A. S. A., chief test pilot U. S. Air Service, wore this parachute in his World Altitude Record flight at McCook's Field.

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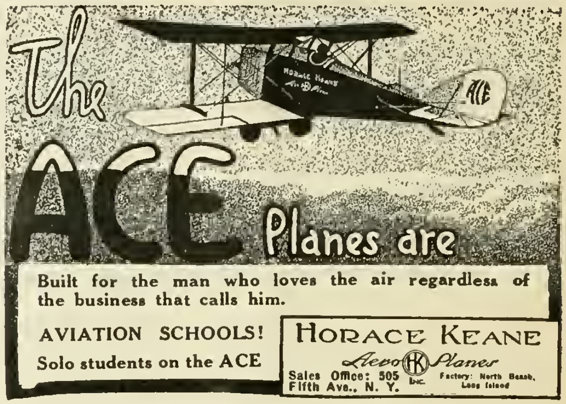
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Used A1 Cylinders (nearly new)	10.00
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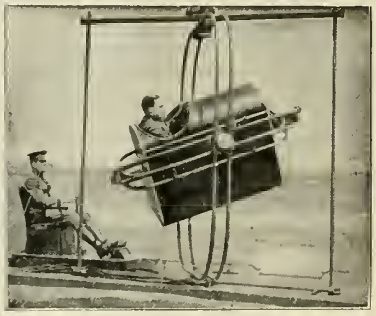

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(*Continued from page* 111)

Detachment		*Approx. Strength*	*From*	*To*
"	....	37	Camp Bragg....	Langley Field
"	(See Note 8)....................	52	Camp Knox..........	Aberdeen
"	(See Note 9)....................	10	Chanute Fd..........	Ft. Riley
"	(See Note 10)....................	100	Chanute Fd........	Mitchel Fd.
"	(See Note 11)....................	95	Chanute Fd........	Carl'm Fd.
"	(See Note 12)....................	180	Fairfield, O..........	Scott Fd.
"	(See Note 13)....................	64	Fairfield, O........	Mitchel Fd.
"	(See Note 14)....................	5	McCook Fd..........	Post Fd.
"	(See Note 15)....................	3	McCook Fd........	Kelly Field
"	(See Note 16)....................	4	McCook Fd........	Mitchel Fd.
"	(See Note 17)....................	2	Middleton, Pa.,..	Mitchel Fd.
"	(See Note 18)....................	2	Middleton, Pa.....	Langley Fd.
"	....	7	Love Field........	Kelly Field

Note 1—The designations carried in this column are the new designations ordered above.

Note 2—Temporary Station Eugene, Oregon.

Note 3—The Second Group, (Bombardment) to be moved consists of:
Headquarters, 2nd Group (Bombardment)
11th Squadron (Bombardment)
20th Squadron (Bombardment)
Air Park No. 5.
Photo Section No. 1.

The 49th and 96th Squadrons (Bombardment) belong to this Group and are now stationed temporarily at Langley Field.

Note 4—To El Paso, Texas, for temporary station.

Note 5—This detachment should be sent in the following grades:
8 Sergeants, 8 Corporals, 2 Privates 1st cl., 2 Privates.

Note 6—This detachment should be sent in the following grades:
6 Sergeants, 9 Corporals, 13 Privates, 1st cl., 22 Privates.
All personnel lighter-than-air.

Note 7—This detachment should comprise all remaining Air Service Personnel at Camp Benning after the detachment of 50 is sent to Lee Hall.

Note 8—This detachment should be sent in the following grades, all personnel lighter-than-air:
4 Sergeants, 4 Corporals, 5 Privates, 1st cl., 39 Privates.

Note 9—This detachment should be sent in the following grades:
1 Master Sergeant, 1 Staff Sergeant, 1 Sergeant, 1 Corporal, 2 Privates, 1st cl., 4 Privates.

Note 10—This detachment should be sent in the following grades:
5 Staff Sergeants, 95 Privates.

Note 11—This detachment should be sent in the following grades:
2 Master Sergeants, 1 Technical Sergeant, 17 Staff Sergeants, 57 Privates.

The detachments sent from Chanute Field should not reduce the total strength of the Mechanics' School, Observation Squadron (reduced strength) and the Photo Section below 210.

Note 12—This detachment should be sent in the following grades:
5 Sergeants, 8 Corporals, 49 Privates, 1st cl., 118 Privates.

Note 13—This detachment should be sent in the following grades:
9 Master Sergeants, 32 Staff Sergeants, 16 Sergeants, 7 Privates, 1st cl.

Note 14—This detachment should be sent in the following grades:
5 Master Sergeants.

Note 15—This detachment should be sent in the following grades:
3 Master Sergeants.

Note 16—This detachment should be sent in the following grades:
4 Staff Sergeants.

Note 17—This detachment should be sent in the following grades:
1 Master Sergeant, 1 Staff Sergeant.

Note 18—This detachment should be sent in the following grades:
1 Staff Sergeant, 1 Corporal.

Note 24—The Gunnery Detachment for Carlstrom Field is to consist of 75 enlisted men and table of organization is being submitted for the same.

7. That Circular No. 208, War Department, 1921, govern as to equipment, property and funds.

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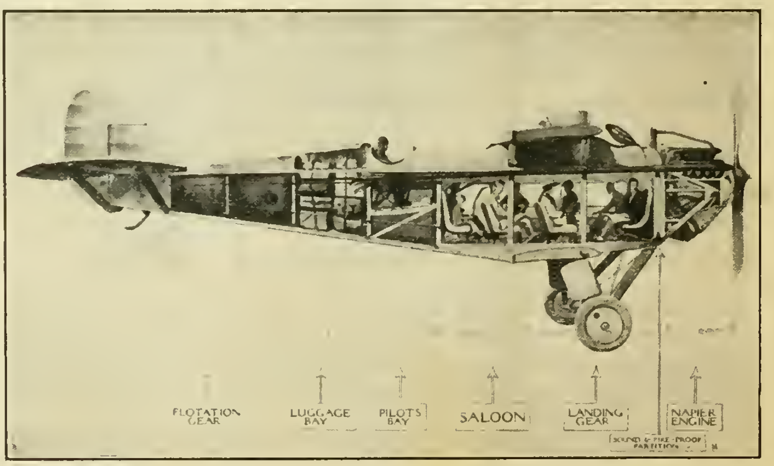

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By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

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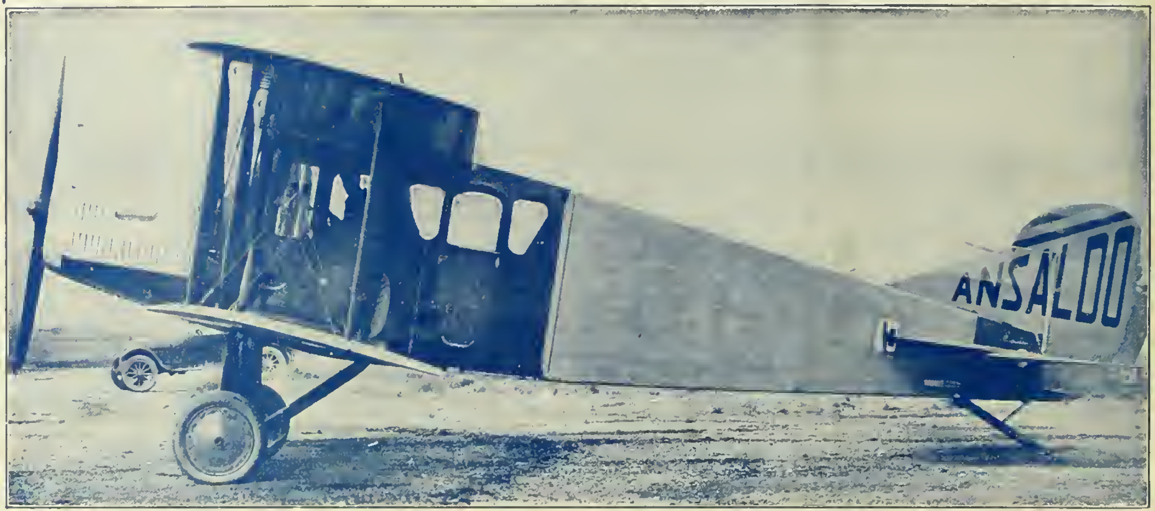

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AERIAL AGE WEEKLY

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The Future of Aviation

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Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

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Flying Club of Kansas City

Room 126 Hotel Baltimore **Kansas City, Missouri**

October 17, 1921

AERIAL AGE WEEKLY

VOL. XIV, No. 6

TABLE OF CONTENTS

The Future of Aviation 123
The News of the Week........... 124
United States Post Office Department Air Mail Service.......... 125
The Aircraft Trade Review 126
MacReady's Altitude Flight 127
Large German Airship Stations.... 128
Admiral Fullam on the Alabama Tests 130
The Rumpler 1000 H.P. Engine... 131
Information for Pilots Giving the Practical Characteristics of the Land Along Various Routes..... 132
What Airships Can Do........... 134
Naval and Military Aeronautics... 135
Foreign News 136
Elementary Aeronautics and Model Notes 137
Aeronitis 138

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VOL. XIV NEW YORK, OCTOBER 17, 1921 NO. 6

THE FUTURE OF AVIATION

IN an interesting article from *La Presse Interallics,* published in the New York *Times,* Henri Farman, the noted French aeronautic pioneer, presents some interesting thoughts on the future of aviation. Following are a few excerpts:

The question of landing grounds is one of primordial importance, and is vital in regard to the future development of aviation. The existing landing grounds are not only insufficient in number, but are situated too far from cities and towns for the use of aircraft to become generally practicable. I am inclined to think that among the many causes that slackened the progress of aviation the principal two are to be found in the continued use of motors primarily designed for war purposes and the shortage of landing grounds on the various aeroplane routes.

Another factor which must also be considered is the lack of interest displayed by the masses of the people in aerial locomotion. The public, I am convinced, will have to be educated in this subject little by little. Crowds have a great tendency, especially in Europe, to be influenced by tradition, and some considerable time must be allowed to enable them to understand and realize the utility of a new invention.

To insure the security and the comfort of aerial passengers, to prove to the public that when they mount into the cabin of an aeroplane they are not performing a heroic act but merely selecting, on the contrary, perhaps, the means of transport that is best calculated to preserve their lives; this is another direction toward which should be directed the efforts of those who know what the coming developments of aviation will probably be, and who foresee an advance in this form of locomotion that will astonish the world.

The purchase price and the running cost of an aeroplane are undoubtedly below those of an automobile. Moreover, if the use of aircraft has up to the present been reserved especially for long-distance traveling, I believe that sooner or later this view will be changed and that the aeroplane will obtain equal popularity for short distances. Later on, in short, I believe we shall take an aeroplane in exactly the same manner as we now jump into a motor-bus or a taxicab.

In the years that are coming aircraft will be called upon to play a pre-eminent rôle not only in the domain of peace relations and commercial life, but also, unhappily, in the sphere of military activity.

The war of the future, I believe, will assume an exclusively aerial and technical form. The aeroplane will no longer be, as it was during the recent frightful struggle, "the eye of the army," but really a decisive factor of victory.

Aeroplanes will be grouped in squadrons of 100 or more machines, and our children will thus see being fought out before their eyes homeric struggles between two formations of this strength.

The most powerful German aeroplanes during the period of the war were able to transport only half a ton of explosives. A Goliath type of aeroplane carries a load of over three tons. A Goliath, moreover, can transport, in addition to its crew, twenty fully armed and equipped soldiers, each accompanied by a machine gun.

It is easy to realize what a really formidable force would be represented by a squadron of 100 aeroplanes carrying cargoes of this kind, for it must not be overlooked that the part that will be played by aeroplanes in the wars of the future will not be confined merely to conflicts against the aerial forces of the enemy.

In addition to the methodical and almost instantaneous bombardment of the towns and cities in the rear of its fighting front—and unhappily the distance from, say, Berlin to Paris is not very great!—aeroplane squadrons will also play a decisive part in the combat of operations on the ground.

Suppose, for instance, that a squadron of Goliaths, each carrying twenty soldiers, succeeds in crossing the enemy's lines without encountering any aerial force belonging to the other side, or that it encounters and fights and destroys an enemy force and is still able to continue on its mission. What would it be able to do?

The victorious squadron might be able to land behind the enemy's lines. In less than a couple of hours a substantial military force would have been massed in the enemy's rear and all his entrenchments and military works would be turned. The troops of the country which had lost the supremacy of the air—the impregnability of the "air front"—would suddenly find themselves compelled to fight on two fronts at the same time, or, rather, to surrender to the enemy.

Down to the present, unfortunately, the German Government and people appear to have realized much more completely than the French Government and people the future military importance of aviation.

It may be asserted without fear of contradiction that the nation which succeeds in acquiring the mastery of the air will secure for itself at the same time pre-eminence in the world. And this fact, I am convinced, is also indisputable; that if a fresh war occurs, its issue will be decided beyond all doubt by aerial fighting.

THE NEWS OF THE WEEK

Mineola Aviation Day

The Contest Committee of the Aero Club of America announces that an Aviation Day will take place on the Curtiss Field, at Mineola on Sunday, Oct. 16, through the courtesy and co-operation of the Curtiss Aeroplane & Motor Co. in loaning the field.

Following is the program of the Aviation Day:

1. Aero show which will last all day. Each exhibitor will have his exhibit on the field in front of a hangar, all of which are numbered and on which he may display a sign. The location of each exhibit will be found in the program, which it is hoped can be given gratis to all paying admission to the field. Should exhibitors wish to insert page advertisements, they may do so for the cost of the printing and paper. By having the exhibits on the field instead of in the buildings the public may examine them at their leisure without being afraid of missing any of the flying.

2. Demonstration flights of aeroplanes. Each exhibitor is requested to make one or more exhibition flights to show the performance of his machine, engine, etc. The nature and duration of each flight should be sent in writing to the Contest Committee of the Aero Club, who will assign a time for each flight and publish it in the program together with the name of machine, engine, pilot, and purpose of the flight. In this way anyone interested in a machine will know at what time it will fly, and the public will know at all times what machines are in the air.

3. Trophy for best completed demonstration of aerial transportation from or to New York by aeroplanes or seaplanes within 8 hrs., starting at 9 a. m. and finishing at 5 p. m. The New York terminus must be the Curtiss Field for aeroplanes, and Port Washington for seaplanes. Contestants shall notify the Contest Committee of their intention to enter, and give name of aeroplane, motor and pilot. The exact nature of each contestant's contemplated trip should be sent in a sealed envelope, which will not be opened until after the entries have closed at noon Oct. 10. This will insure entrants against having their ideas stolen or copied, but will give time to have the proposed trips printed in the program and newspapers. Each contestant should explain fully the advantages of his proposed trip over the other means of transportation, measuring it in time, dollars and cents, or any other way, to assist the judges in awarding the trophy. The judges shall be the Aviation Editors of the New York papers, and the trophy shall be awarded on points as follows: Each editor shall publish in his paper his choice for the first five places, and in each published list the Contest Committee will award 5 points for first place, 4 points for second place, 3 points for third place, 2 points for fourth place, and 1 point for fifth place. The contestant receiving the greatest number of points shall be awarded the trophy. However, no contestant shall be eligible for the trophy unless the proposed flight is actually completed.

Air Mail Planes at Kansas City

As a special mark of appreciation to Marshall Foch, who will be the guest, with other notables, of the American Legion at the third annual convention in Kansas City, Mo., on October 31, November 1st and 2nd, Postmaster-General Hays has arranged to have an Air Mail squadron of six aeroplanes fly to Kansas City on one of the days of the convention. The ships of this squadron will be regular mail planes mobilized at Omaha from stations on the transcontinental route—from New York to San Francisco—and will fly in formation from Omaha to Kansas City. Air Mail service has been authorized between Kansas City and Omaha during the American Legion Convention.

French Motor Prize

Paris.—The French Committee for Aeronautic Propaganda has decided to create a prize of 1,000,000 francs for the commercial aviation motor which best satisfies tests in a competition to be arranged, in point of durability, regularity, simplicity, dismounting and upkeep.

The competition, according to the committee's announcement, will be international, under the regulations of the International Aeronautic Federation, but a foreign builder taking part must engage to construct his motor in France, if he wins. Motors should be ready by June 1, 1923, and the Aero Club of France has been intrusted with carrying out the competition.

No Blame Fixed for ZR-2 Disaster

London.—At the adjourned inquest upon the victims of the R-38 disaster at Hull, the jury on October 4 returned a verdict of accidental death and found no evidence regarding the actual cause of the dirigible's destruction.

This decision, unsatisfactory so far as the second part is concerned, followed a most remarkable summing up speech by Deputy Coroner T. C. Jackson, who gave opinions expressing satisfaction with the ship's construction and condition which were not supported by any evidence heard during the inquest. He gave no authority for the several such statements made. The only source from which he could have got them is the unpublished report of the Air Ministry investigation.

If the full evidence of that inquiry is not published, in view of the failure of the Coroner's Jury to disclose the cause of the accident, the public may never know whether there is any truth in the repeated unofficial reports that the authorities knew the ship was not airworthy. Dr. Jackson gave the jury this assurance, however:

"Tests made during the progress of the construction were satisfactory and any necessary modifications were carried out." Further on, after referring in considerable detail to the faults discovered and repairs and changes made during construction and after the first flying trials, he again assured the jury:

"Everybody was quite satisfied that nothing further could be done and the vessel represented the last word in human foresight, skill and knowledge in airship construction of this kind."

Loening Establishes Another Record

Traveling at an altitude of 10,000 feet a Loening flying yacht on October 7, established what was said to be a new world seaplane speed record when it flew from Aberdeen, Md., to Port Washington, L. I., an airway distance of 188 miles, in 80 minutes, more than two miles a minute. The eigthy-eight miles airway distance from Philadelphia to the Battery was covered in 32 minutes.

The feat was all the more remarkable because of the fact that Clifford Webster, the pilot, was handicapped by strong wind currents which made it necessary for him to mount to 10,000 feet, where he found conditions favorable for fast flying.

Those who made the trip were Grover Loening, the designer and builder; H. C. Richardson, who commanded one of the N-C flying boats in the transatlantic race; a mechanician and Pilot Webster. A fourth passenger was landed at Philadelphia, but as the plane did not remain there the flight was considered virtually a non-stop one. The party flew from Port Washington to Aberdeen, but strong head winds made it impossible for the plane to fly the maximum speed with which it is credited.

"We left Aberdeen, where I had been called on business, at 3:10 in the afternoon," Mr. Loening said. "We decided not to follow the water route generally used by seaplanes, but to take the direct land route back to Port Washington. We had made many tests with the flying boat and believed that it could negotiate the distance without any trouble.

"For a short distance we flew at a height of 2,000 feet, but the pilot experienced difficulty with a strong wind current, which made it difficult to get the desired speed out of the plane. He decided to climb to 10,000 feet to find if the air was better there. We mounted the 8,000 feet at the rate of 1,000 feet a minute.

"Here we found conditions ideal. There was a good tail wind which enabled us to go forward with increased speed. We traveled the distance between Aberdeen and Philadelphia in a half hour. Thirty-two minutes after we left Philadelphia we were over the Battery. It is worth noting that had anything gone wrong with our engine we could have glided from the height we maintained to a waterway landing spot with perfect safety.

"We could have clipped a few minutes from our time, if it were not for the necessity of coming down from 10,000 feet. I feel certain that the flying boat can better that time and hang up a new record which will remain for some time."

Pilot Webster was enthusiastic over the performance of the plane, which has been undergoing a series of tests since it was developed in the early part of the Summer. He said that the 400-horsepower Liberty motor hand functioned perfectly.

King of Spain Joins Air Commuters

Paris.—King Alfonso of Spain has joined the ranks of royal air commuters. An air taxi designed for his personal use, has been completed by a French firm. The machine will make 130 miles an hour and bears the royal coat of arms. Jaille, a well known French pilot, will act as chauffeur.

Added Kansas City Event

Another event has been added to the long list of contests to be held at Kansas City. This will be a long distance endurance race to Kansas City from a minimum distance of 600 miles. There will be $1,000 cash prize for the winner, and $500 for the contestant with the second best record.

Wind Aloft

Wind Aloft is the name of a new weekly newsletter published by officers and men at Ross Field, Arcadia, California. It is now printed in multigraph form, but its material justifies a better dress and it is to be hoped that the editorial board will make it a regular sheet in the near future. We extend to the editors our cordial good wishes.

Mayor Smith Extends Welcome

John F. Smith of Lorimor, Iowa, who is an enthusiastic aeronautic supporter, informs us that he offers a cordial welcome to all cross-country pilots in that territory who visit the city of Lorimor. High test gas and lubricating oil is always available.

Pilot Abandons Siberian Flight

Prince Rupert, B. C.—Pilot Prest, of Nevada, who has been waiting here for favorable weather on which to hop off for the last lap of a flight from Mexico to Siberia, has abandoned the flight for this year following a second accident to his biplane.

His biplane, the Polar Bear, was wrecked in a gale September 29. It was carried 200 feet from its moorings and was badly smashed up. Prest said he intended to repeat his attempt next year, to fly from Mexico to Siberia, and will travel over the same route on which he so nearly completed the journey.

Flight to Encircle World Projected

London.—Capt. Sir Ross Smith, who made a successful air flight from England to Australia, will start shortly on an air flight around the world, according to the *Daily Mail*.

He will use a machine enabling him to alight with equal ease on land and water, and proposes, after crossing from Europe to Asia, to fly from Japan to Alaska, thence across Canada to Nova Scotia, possibly making a detour southward, visiting Chicago and New York, before heading for Nova Scotia.

Chicago Colored Girl Learns to Fly Abroad

Miss Bessie Coleman, a colored girl of Chicago, twenty-four years old, who had been studying aviation in France for ten months, arrived in New York recently on the American liner Manchuria. She brought with her credentials from the French certifying that she had qualified as an aviatrix.

Miss Coleman, who is having a special Nieuport scout plane built for her in France, said yesterday that she intended to make flights in this country as an inspiration for people of her race to take up aviation.

Dr. Ames on Aviation Development

"We must go ahead with the development of aviation in all its branches," states Dr. Joseph S. Ames of the National Advisory Committee for Aeronautics in an interview with the Associated Press. "The recent bombing tests of aeroplanes versus battleships off the Virginia Capes have served to indicate the great possibilities of aircraft in coast defense and naval warfare, and to accentuate the demand for progress in aeronautical development.

"There must be special development both in the Army and in the Navy for their respective services. Civil aviation must also be developed, for in the last analysis it should be the main support of the industry in time of peace. The first requirement for the development of civil aviation is that there should be Federal regulation of air navigation. A number of bills have been introduced in Congress to establish a Bureau of Air Navigation in the Department of Commerce, and it is hoped that Congress will take action at an early date."

Dr. Ames pointed out that in the present demand for economy in government there is danger that the development of aviation may be unwisely retarded. He states that economy can be wisely effected only where economy is possible without retarding necessary development, and that it will be a mistake to retard the development of aviation on the ground of economy in Government expenditures if it is at all possible to effect the necessary economies elsewhere. Continuing, Dr. Ames pointed out that in time of peace there must be an increase in scientific research and experimental investigations to assure that there may be any substantial development in aviation. Those industrial organizations which maintain research laboratories have recognized the imperative need of fully maintaining scientific research in times of business depression, the necessary economies being effected in other branches of their organizations.

"The aeronautic industry," said Dr. Ames, "has discontinued research laboratories which were once maintained by aircraft manufacturers, and in some instances manufacturers have even dispensed with their engineers and designers. The lessening of production has greatly reduced the volume of experimental work done by manufacturers, until now it is almost negligible. Under these circumstances, and in view of the fact that the governments of several European countries are supporting the development of aeronautics, it is essential that our Government should fully maintain scientific research in aeronautics.

"Civil aviation demands the development of cheaper, more reliable, and more efficient aircraft. The National Advisory Committee for Aeronautics has gone on record to the effect that without the continuous prosecution of scientific research and experimentation the development of aircraft for any purpose, for the Army or the Navy Air Service, the Air Mail Service, or for civil aviation generally, is impossible."

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, August, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Testing & Experimental Work at College Park	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST					
															Gallons of Gasoline	Total Time Run		Total Miles Run	Cost per Hour	Cost per Mile
																hr.	min.			
EASTERN New York-Chicago.....	$5,489.96	$997.92	$3,230.84	$3,095.20	$1,707.85	$638.00	$3,093.39	$1,616.73	$4,564.33	$4,853.57	$363.38	$1,615.65	$835.95	$32,102.77	14,211	475	51	42,196	$57.44	$0.76
CENTRAL Chicago-Rock Springs.	5,702.40	1,508.37	2,786.78	4,111.09	1,472.85	336.85	2,478.49	2,341.48	6,352.50	6,046.60	526.27	2,339.91	1,210.68	37,214.27	21,255	761	10	65,528	48.88	.57
WESTERN Rock Springs-San Francisco	3,518.81	1,007.24	*14,930.52	1,808.10	1,034.72	231.07	2,751.57	1,616.73	3,847.37	4,108.82	363.38	1,615.66	835.95	37,669.94	12,352	459	29	41,708	81.97	.90
Totals and Averages....	$14,711.17	$3,513.53	$20,948.14	$9,014.39	$4,215.42	$1,205.92	$8,323.45	$5,574.94	$14,764.20	$15,008.99	$1,253.03	$5,571.22	$2,882.58	$106,986.98	47,818	1,696	30	149,432	$63.06	$0.71

* Includes new motors in Planes No. 101 and No. 169, and new wings and ailerons on Plane No. 107.

Total Operating Cost..........	$106,986.98
Loss on unrepairable crashes....	8,000.00
Permanent improvements..........	2,242.61
Grand Total..........	$117,229.59

Overhead consists of:
Departmental Overhead; Office Force and Watchmen; Motorcycles and Trucks; Rent, Light, Fuel, Power, Telephone and Water; Radio; Testing and Experimental Work.
Maintenance consists of:
Miscellaneous; Mechanics and Helpers; Repairs and Accessories; and Warehouse.
Flying consists of:
Gas; Grease and Oil, and Pilots.

COST PER MILE

Division	Overhead	Flying	Maintenance
Eastern..........	$0.20	$0.26	$0.30
Central..........	.13	.21	.23
Western..........	.16	.20	.54
Entire Service..........	$0.16	$0.22	$0.33

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Central States Aeronautical Corporation Organized

The Central States Aeronautical Corp. has been organized in Indianapolis with a capitalization of $300,000.00. It is divided into two departments—the Engine Division and the Air Division. The Engine Division will have charge of the production of the "Peggy" Internal Combustion Engine, the invention of Mr. Samuel R. McBride, who served as an officer in the Air Service and later in the Engineer Corps. The Engine Division will also have charge of the production of the "Spencer" Engine, the invention of Mr. Owen H. Spencer, president of the Research Engineering Company at Dayton and formerly of McCook Field. The initial tests of these engines showed some remarkable developments which we hope to describe more at length in an early issue.

The Air Division will operate an air line between Indianapolis and Miami, Florida, during the forthcoming touring season.

This concern has among its personnel: Charles H. (Billy) Wilcox, Chief Pilot. Member of the Lafayette Escadrille, later at McCook Field on Caproni work, etc. Odis A. Porter, official timer of all sanctioned sped contests in the United States. Owen H. Spencer, president of the Research Engineering Co., holder of several patents pertaining to equipment for production work on Liberty engines, inventor of the Spencer engine, etc. Frank H. Dungan, production manager of the Spacke Machine Co. Samuel R. McBride, inventor of the Peggy engine, the Maybury propeller gear, the Hoosier mooring mast and the American airship structural designs.

Exports of New Planes and Parts

	Month of August			
	1920		1921	
	No.	Value	No.	Value
Aeroplanes			5	$47,165
Aeroplane parts		$2,120		15,005

	8 Mos. Ending Aug.			
	1920		1921	
	No.	Value	No.	Value
Aeroplanes	41	$381,204	35	$240,940
Aeroplane parts		507,358		128,578

Aircraft Plant May Be Built in America

It appears from a Washington despatch in *Automotive Industries* that the plea of the National Advisory Committee for Aeronautics for further researches into dirigible transportation will have a salutary effect upon the developement of this industry in the United States. The destruction of ZR-2, built in England for the United States Navy, brought about the resolution of the Advisory Committee and may result in the establishment of an aircraft plant in this country under the auspices of the Government, in order to conduct experimental work for obtaining definite information regarding the strength and quality of materials and girders used in the construction of airships and for the development and checking of theories used in the general design of aeroplanes.

Several groups of American financiers are deeply interested in the promotion of aerial transportation, especially through the use of rigid airships. Negotiations are now under way with the DuPont, U. S. Steel Corp., and General Electric Co., and other powerful financial interests for the establishment of dirigible routes to New York and Chicago. Several conferences have been held and experts employed by the syndicate have reported a system of dirigible transportation would be feasible and profitable.

Trade With Spain

The American Chamber of Commerce in Spain intends to edit in the early part of December a special number of its Monthly Bulletin and has requested us to publish this notice for the information of those who might wish to avail themselves of its special edition and contract for advertising space therein. Full particulars may be had from the American Chamber of Commerce in Spain, Rambla de los Estudios 8, Barcelona, or from Mr. Eugene L. Perea, care of Messrs. Boera Brothers, Staten Island, Ferry Terminal Building, New York City.

American Airways Active

The American Airways, Inc., operating a training school for air mechanics, and aerial "garage," at College Point, L. I., announce that they are in an excellent position to handle overhaul jobs for seaplanes which have had a hard season and wish to get fitted out for the winter. The facilities for this work are excellent, and all repairs, etc., are under the direct supervision of Captain T. L. Tibbs, formerly of the Aeromarine Airways. The work is all done on a basis of actual cost of material and labor, plus a twenty-five per cent charge for overhead. The result is high class work done very reasonably.

In addition to this, cadet-mechanics are able to do a great deal of the detail work which usually runs into considerable money and for this there is no charge.

The American Airways hangars are located on the Point at College Point, which is the promontory on the northeast of Flushing Bay and the East River. The building is part of the College Point Boat Corp., and is quite large and easily identified by wireless, flag and slipway.

Seaplanes will also be built reasonably, to order, as well as fast "aqua-sleds" with aeroplane motors and propellers.

Army Purchases Fokkers

The United States Army Air Service has purchased two twelve-passenger Fokker monoplanes, according to an announcement by the Netherlands Aircraft Manufacturing Company, 286 Fifth avenue, American representatives of Anthony G. H. Fokker, the Dutch aircraft designer. The planes, said to be the largest of their kind in the world, were shipped last week from Amsterdam.

The twelve-passenger F-4, as it is called, has a cruising speed of 110 miles an hour. The plane is equipped with a 400-horsepower Liberty motor. With a gasoline capacity of 120 gallons, the F-4, in one of its tests, flew more than 600 miles without landing, the announcement said. The planes are to be delivered at McCook Field, Dayton, Ohio.

A Remarkable Flight

The most remarkable long distance passenger flight in the history of aerial navigation was completed recently when the giant eleven-passenger flying cruiser "Santa Maria" landed at New Orleans after a complete circumnavigation of the Eastern section of the United States.

During this flight the "Santa Maria," which is the largest passenger flying boat in the world, has covered 18,000 miles in the air, and transported more than 2,000 passengers in absolute safety. In establishing this record-breaking standard of efficiency, she has been in the air during this trip a total of 270 hours. As far as is known, this achievement is unsurpassed by any other aircraft.

This outstanding flight commenced at Key West when the Aero-Marine Airways, with the co-operation of the United States Navy Department, undertook to fly the "Santa Maria" up the Atlantic Seaboard to Washington and New York, and thence overland about the waterways of New York State to Montreal, and along the Great Lakes to Chicago. From the latter city the "Santa Maria" proceeded to New Orleans along the valleys of the Illinois and Mississippi rivers.

While the total distance of this aerial voyage is probably not more than 5,500 miles as the crow flies, the "Santa Maria" made a large number of passenger flights at each of the cities she visited. Among her through passengers she has had a representative of the U. S. Navy throughout, first in the person of Admiral C. J. Peoples, and then Commander P. N. L. Bellinger of NC-1 fame. Both were specially assigned by the Navy Department, which fostered the flight as a means of aiding in the upbuilding of commercial aviation in this country.

Kloor of Balloon Fame Out of Navy

Lieut. Louis A. Kloor, Naval Reserve Officer of the naval air service, who commanded the balloon which landed in the Hudson Bay country last December and nearly lost his life, with his two companions, Lieuts. Farrell and Hinton, received orders from Washington detaching him from the service November 1, with leave of absence until that time. Lieut. Kloor did not take the examination last May for reserve officers, and the message was no surprise to him, he said.

It was said at Washington that the dropping of Lieut. Kloor was simply a matter of routine. In cutting down the navy personnel, it was said, reserve officers who did not take the examinations were the first to go, as it was assumed they did not care to remain. It is understood he intends to return to his home at Crowley, La., where he will enter the automobile business.

MacREADY'S ALTITUDE FLIGHT

IN a special despatch to the New York *World*, Lieut. John A. MacReady tells the remarkable story of his world's altitude record flight as follows:

"It wasn't a record I was after when I started out on the flight which ultimately resulted in upsetting Major R. W. Schroeder's altitude record, but to test a new propeller and additional equipment on the Moss supercharger, which has been experimented with extensively at Cook Field.

"One of the functions of the engineering division is the development of aeroplanes and equipment for military use at high altitude. Continual effort is being made to develop planes which will be better than the planes of other nations for combat or observation work at extremely long distances over the ground.

"My record flight yesterday was a test flight and the record was incidental to the very valuable engine, propeller and supercharger data which were obtained.

Day Was Ideal for Trip

"The day was ideal—warm and clear—just the sort of day on which the best results are obtained at altitude. The warmer the day is the better instrument results are obtainable, because the pressure and density corrections do not bring the final height so low after all instruments are checked up and calibrated.

"After a good night's sleep to insure the best physical condition for the flight I arrived at the field and began at once to make immediate preparations toward insuring reliability of all factors which are necessary to obtain safety and comfort when undergoing the hardships which one encounters in this work. The mechanics had stripped the plane of all excess weight by cutting out unnecessary equipment and by reducing the ordinary gas capacity.

Unnecessary Gear Stripped

"The supply of oxygen was also reduced for the reason that in all previous flights I had flown with an observer, thus making it necessary to have an almost double supply of oxygen. Roy Langham had been my observer on all previous flights of altitude, but in this particular case it was not necessary for him to take readings, as the data to be obtained was such that I could get it myself with very few readings and observations.

"The plane climbed remarkably well considering the original slow speed of the propeller. This propeller was a very large one, having a ground speed of only 1,100 revolutions a minute, whereas most propellers have a speed around 1,600. The density of the atmosphere decreases with altitude, and a propeller turning slowly at the ground would have great speed as the plane rose more and more into the lighter air. On one previous flight the propeller speeded up from 1,450 r.p.m. at the ground to 2,400 r.p.m. at 34,000 feet, which was the ceiling of this particular flight; and on another occasion, when attempting an altitude flight, the propeller flew off the plane in the air, knocking off the air speed indicator, which was attached to the wing strut of the plane, and hitting the strut, because of this excess speed.

Had Been Trying for Years

"For more than a year I have been attempting to reach an altitude higher than has previously been made, but on all occasions something has broken while taking the plane up on the flight, and it has been necessary to descend in trouble. Oil pipes and bearings have broken in the engine, parts of the supercharger have flown off in the air, and the propeller has been lost in flight. The majority of these flights have been test flights around 25,000 feet for the purpose of obtaining data.

"Everything was functioning properly during the early part of this flight on which the record was broken. As altitude was gained I became more confident that success would be attained because in all flights I have made with the supercharger none had shown such excellent functioning during the early part of the trip. All the mechanisms were working in excellent order; I began using oxygen at approximately 20,000 feet, using it very sparingly at first in order that there would be sufficient in case of emergency.

"I was well protected against the cold. Over my military uniform was a heavy suit of woolen underwear and over this was a thick, heavily padded leather covered suit made of down and feathers. On my feet were fleece lined leather moccasins. My hands were covered with fur-lined gloves. My leather head mask was lined with fur and an oxygen mask was attached to it.

"The goggles were separate and were placed on the outside of the head mask. The inside of the goggles was covered with a film of secret gelatine compound which was painted over the glass. This gelatine compound is for the purpose of keeping the ice from forming on the inside of the goggles. It is supposed to function in this respect to a temperature of approximately 60 degrees Fahrenheit below freezing.

"In addition to the standard oxygen equipment of five flasks containing together a pressure of 2,300 pounds, I had an additional emergency flask containing a pressure of 1,500 pounds, which would lead directly from the flask through a tube into my mouth. At 10,000 feet I passed through a stratum of clouds and at 20,000 feet passed through another stratum which somewhat obscured the ground and hindered me in locating my position with respect to the geography of

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Lieut. J. A. MacReady just after he had broken the world's altitude record. With him are Dr. Sanford A. Moss, Capt. G. E. A. Hallett, and Adolph Berger the ground. I did not feel any ill effects whatever until well above 30,000 feet, as I was receiving plenty of oxygen and was warm enough, but as the altitude above 30,000 feet was reached a slight slowing up of one's senses and faculties was noticeable and this slowing up increased as altitude above this height was gained. Any exertion calls for oxygen. The faculties do not function normally.

"If I would stoop over to make some adjustment I would feel the need ,for oxygen. This need is manifest by the objects on the ground and the instruments in the cockpit becoming dim and shaky. Whenever I felt these effects I would turn on a little more oxygen, which was flowing well and freely. I was worried at no time until approximately 39,000 feet was reached.

"At this altitude ice from my breath within the mask must have clogged the oxygen pipe, for the reason that I felt the force becoming diminished and began to feel very bad effects from its lack. I tried to blow this out and did succeed in getting a taste of ice, but could not act quickly enough to clear the entire tube, so swung over to the emergency flask and tore a small plaster from the side of my mask, placing the tube through this aperture directly into my mouth within the mask and in an instant was feeling comparatively normal.

"I was supercharging to sea level condition at 40,800 feet (indicated) and expected that flying on the engine alone I would probably reach 7,000 or 8,000 feet more, but this was not the case. As soon as sea conditions were lost on the engines the power was quickly diminished and I could only get 100 feet more altitude, which was the absolute ceiling of the plane.

"While hanging suspended at an indicated altitude on the dial of 41,200 feet the plane swung and rolled and very little action on the controls could be obtained. The controls were almost useless, as there was not enough sustaining surface to move the plane in the direction that was desired.

"It was at this point practically without control, and I held it there for almost five minutes before I was absolutely certain it would go no further. When assured of this I pulled the throttle slightly back in order to glide down, but even with this small movement the bottom seemed to drop out of the plane and down it quickly went toward earth.

Ice Now Blinds Goggles

"Before I could make the proper readjustments the engine and radiator had cooled so quickly that there was no warmth in the cockpit from the radiator pipes running through it to warm the pilot, and as a result it became much colder in the cockpit, resulting in ice forming on the inside of my goggles, making me almost blind for the instant, and I could not handle the plane correctly for a short time. I was feeling weak and groggy and was afraid of passing out completely.

"My mind was not active and I could not think fast and correctly. However, I knew that by reducing my altitude I would come back to normal and be able to make all adjustments if I could get down lower. I let the plane come down almost any way in order to get it down where I could think correctly.

"I neglected to say that just before or while I was at the supreme altitude that I remembered that Major Bane had asked me to look above me while at the great height and see if I could see the stars or any constellations and note the appearance of the sky and any peculiar features which might exist. This I did.

"I was unable to see any stars, but one fact was brought forcibly to my mind, and that was the fact that the atmosphere was extremely bright and light.

Sky Light Blue, Not Dark

"Instead of being a dark blue, as is the case at the ground, the sky was very light in color, with but a slight blue tinge. There is far more sunlight, and it is far brighter at this altitude than closer to the ground. Another point that I neglected was the fact that while climbing to the ceiling I was circling around the City of Dayton, gradually increasing the size of circle as altitude was gained in order to always be within gliding distance of the field or of Dayton. This circle as altitude was gained increased its radius until at the top of radius of about sixty or seventy miles. I attempted to keep this circle round, with Dayton as the center, but strong, heavy winds tended to drift me in various directions. I do not know what these directions were, for the reason that my mind was not sufficiently acute to be able to know all these facts.

"The original part of the return to earth was made in a very confused state, but as altitude was lost, elements of consciousness became clearer, and at about 30,000 feet I was beginning to feel normal again. Here I changed goggles and continued my glide toward earth, flying around at 20,000 feet for a period of approximately twenty minutes, in order that the change in condition from my altitude to the ground would not be too sudden.

Inventor Came Within 200 Feet

"I landed and taxied to the line where the boys in the hangars and on the field were waiting, curious to know the results of the flight. A pool had been made on the hangar, the different mechanics betting on the altitude. Dr. Moss, inventor of the supercharger, won the pool with a guess of 41,000 feet. The actual calibrated altitude of the flight, as indicated in the barograph charts, was 40,800 feet, which is the highest altitude any living being has made.

"I wish to again call attention to the fact that this record flight is but merely incidental in the chain of development of superchargers undergone by the engineering division of the air service and is the finished and perfected work of this development. Superchargers are in such a state now, due to the developing department under Major T. H. Bane, Capt. G. E. A. Hallett, Dr. S. A. Moss and Adolph Berger, chief of the power plant at the field, that they should be fairly consistent at extremely high altitudes in the future

"Yet, in my opinion, altitude records will not be gauged by the superchargers themselves, but by the physical limitations of the pilots. To get much higher, greater provision of some method will have to be made or it will be impossible for a pilot to sustain the extreme hardship."

LARGE GERMAN AIRSHIP STATIONS

By J. SABATIER *

THE strength of a country's air service does not depend simply on the number of its pilots and machines, but also on the character of its factories and its stationary plants (parks, airdromes, etc.). It may even be said that the latter elements are the most immediately necessary, for, though it is possible to improvise an air fleet quite quickly, as during the war, it is a much slower and more costly process to create the inner structure which alone can give the requisite stability.

For nothing, moreover, is there greater need of stations well equipped with tools than for airships. Thus, on going over the list of 73 airship hangars, which the Germans possessed at the time of the armistice, and the stations they have created, not only in Germany but also in Poland, Bulgaria, and Hungary, we cannot help thinking that a country possessing such elements of aerial power remains redoubtable, even though it has temporarily lost the airships once contained in these stations. It also makes us realize that our own country should have stations comparable with those of its rivals.

In this connection, it is profitable to examine the organization and equipment of the German airship stations. The stations best adapted for serving as the basis of this study were chiefly constructed by the German Navy, during the war, for exclusively military purposes and do not therefore entirely satisfy the conditions of exploitation required for a civilian air service. The requisite modifications for satisfying the latter conditions may nevertheless be readily determined according to circumstances.

General Plan of an Airship Station

This depends first on the number and kind of hangars it has. From this point of view, "L'Aeronautique" has already considered the advantages presented by orientable hangars (See "L'Aeronautique," for July, 1920). In spite of these advantages, the Germans employed during the war only one movable hangar, that at Nordholz. The dispositions made in various stations, notably at Schneidemuhl, indicate however that, if circumstances had permitted it, the employment of revolving hangars would have been much more common. It is, in fact, probable that the necessity of rapid and economical construction led our enemies to resort to the almost exclusive use of stationary structures with simple metal frames.

On glancing at the plan of a large German station, we are first struck by the large space occupied. At Nordholz, about 1200 hectares (3000 acres) are occupied by the maneuvering fields and their dependencies. The hangars themselves seem to have been dropped at random on this vast expanse, without any of the alinements or geometrical arrangements often found in other countries.

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* Translated from "L'Aeronautique", by the National Advisory Committee for Aeronautics.

This disorder is however more apparent than real. The hangars are, in fact, generally constructed in pairs, each with perfectly free access at both ends. Besides, each pair is oriented differently from the others, so that, whatever the prevailing wind direction, one or the other of them is favorably situated for the entry or exit of its airships.

There are evident advantages in such a plan for the utilization of the airships, but unfortunately it leads to multiplying the hangars and distributing them over extensive fields. Besides, since the most accessible hangars vary according to the direction of the wind, it is necessary, in order to guarantee regular service, to have in each group one airship always ready to start, and a free place for any airship returning to port unexpectedly.

The most complete application of the above-mentioned principle is at the Nordholz station which has, in addition to its rotary hangar, three groups of hangars oriented at 120° with reference to one another. The distance between each group and the others is from 500 to 1000 m., making the maneuvering fields entirely independent of one another. There is room in each group for four airships, corresponding normally to one on the point of departing, two in reserve or being repaired and, lastly, to one place available for the reception of any airship returning to port.

We also find similar dispositions at Ahlhorn. However, in order to save space (500 to 600 hectares, instead of 1000 to 1200), the groups are nearer together and their landing fields partially overlap.

Let us note, in passing, that the employment of revolving hangars would have given the same facilities for maneuvering and, other things being equal, with less space and fewer airships.

Construction Details. Hangar Accessories

The existing large airships are about 225 m. long by 26 m. wide and 30 m. high. The newest German hangars are 260 x 75 x 40 m. and each can hold two airships side by side. A double hangar has great advantages. In the first place, it can be used as a single hangar in case a rapid increase in the size of airships should render it necessary. Furthermore, the maneuvers of entering and leaving the hangars would be facilitated by the greater width between the doorposts. On the other hand, the risk is greater in case of fire.

Each pair of hangars constitutes, in Germany, an autonomous whole, which is served by a standard-gauge railway and provided with storehouses and barracks.

This independence, which is still further accentuated by the considerable distance generally existing between the groups, is advantageous from the military point of view, since it limits the possible destructive effects of a fire or bombardment. It is more subject to criticism from the industrial point of view, because a more compact arrangement would make it possible to reduce the number of plants and facilitate their operation, besides economizing in the size of the field occupied.

The hangars, considered individually, should, above all, be designed with a view to facilitating the care of the airships contained in them. They should also be protected against fire.

In caring for an airship, it is necessary to go about without a light, not only around the balloon and its cars, but even inside the envelope, especially in the keel corridor. It is therefore essential that the daylight illumination of the hangar be well provided for. The light must also be well diffused, in order to avoid contrasts of light and shadow which greatly obstruct the view inside the envelope. In the German hangars, windows cover not only the side walls but also the roof and the end doors. They cover about one-third of the surface. The glass is colored yellow in order to reduce the chemical action of the sun on the fabrics.

By night, it is especially necessary to illuminate the floor and the roof of the hangar on account of the operations of propping and suspending the frame of the airship. Lamps must therefore be installed a few meters from the ground and also under the roof. The precautions prescribed for localities where combustible gases may accumulate apply also to lamps, to their wiring and to their accessories.

It is also essential for the good preservation of the balloon fabrics, and especially for goldbeater's fabrics, to avoid excessive dryness or humidity, frost or high temperatures.

Excessive dryness is prevented in summer by a systematic sprinkling of the hangar floor, combined with energetic ventilation. The cold and humidity are combated by means of a central radiator well spread out.

Lastly, the hangar walls are covered with heat-insulating materials (bitumenated cardboard and asbestos board), and the roof is provided with large ventilating chimneys. Each hangar has about thirty of these chimneys, which are about 0.6 m. in diameter, and can be closed by movable trap doors. The side windows have a movable part for creating air circulation about the balloons.

Said devices serve not only for the protection of the hangar against the heat, but also against fire, by the rapid elimination of the combustible gases escaping from the balloonets. This elimination is especially important during inflation and, above all, during deflation of the balloon.

The gas conduits (which are generally double and 0.5 to 0.6 m. in diameter) are buried under the floor of the hangar and are provided every 20 m. with strong branch valves. The connection between the stationary conduits and the balloonets is made by strong flexible sleeves from 6 to 7 cm. in diameter, terminating in dust filters. Precautions are taken to prevent the formation of dangerous sparks from the electrization due to the friction of the gas on the metal parts of the filters.

The gasoline is never handled in the open air. It is stored in subterranean reservoirs of 30 to 60 cu.m. capacity. The upper part of these cisterns is filled with some inert gas, generally carbon dioxide, which renders it possible to force the fuel into the portable distribution tanks mounted on wheels and provided with pumps and safety cocks. These tanks deliver the fuel to the various tanks on the airship.

Of course, the foregoing precautions against fire are supplemented by numerous fire extinguishers and a complete system of water pipes under pressure. There are, in general, on each side of the hangar, about every 50 meters, hydrants with two branches, provided with ordinary hose and nozzles.

Independently of the above dispositions, it is interesting to note the following accessories with which German hangars are generally provided. A tank of distilled water, capable of being heated, serves for filling the radiators. Piping for the distribution of ordinary water likewise serves for filling the ballast bags. One or two towers, of variable height, similar to the ones used in repairing telegraph lines, three or four portable ladders with adjustable inclination, numerous ordinary ladders and several connecting bridges enable access to the various parts of the envelope. Lastly, there are usually under the roof three longitudinal bridges along which run suspension rails, which serve as supports for the frames of airships held in reserve or being inflated.

Maneuvering Fields and Accessories

The maneuvering fields occupy, as we have seen, extensive tracts of land. Each group has, as a rule, two fields at each end of the corresponding hangars. The ground is leveled and carefully drained. All telegraph and other wires are put under ground and no obstacle is left to interfere with the work of the landing gangs.

For removing the airships from the hangars or for returning them, use is uniformly made of two guiding rails in underground conduits. Heavy cars run on these rails which hold them equally well either horizontally or vertically. The rails pass through the whole length of the hangar and extend into the field about 250 m., or a little more than the length of the airship. When the hangars are double and contain normally two airships, there are three rails, one of which serves both ships in common.

The guiding cars are mounted on ball bearings and are easily controlled, in spite of their weight. They are provided with a very rapid slacking device. Generally two of these cars are employed on either side of the airship, or four in all, but this number may be increased to six in case of bad weather.

This device seems to have given complete satisfaction, since it is uniformly employed in all German stations and since it has not been considered advisable to resort to screens, outside ports and devices for mooring in the open air, which are favored in France, and especially, in England.

On the landing fields and hangars there are, of course, night landing lights and meteorological and radio stations. In case of fog recourse is frequently had to a captive observation balloon.

Hydrogen Works

In concluding, we have a few words to add on the German hydrogen works. These plants have a capacity suspected by few persons in France. At Ahlhorn their capacity of production is 70,000 cu.m. per day. Let us recall, for the sake of comparison, that the large French works, based, it is true, on other processes, delivered during hostilities hardly 4000 cu.m. per day.

Most of the German works employ the so-called "iron" process, that is, the decomposition of steam by red-hot iron and the regeneration of the iron oxide by a current of water gas. Since this method requires highly heated furnaces, it is economical only when continuous. Since, however, its consumption is not regular, extensive facilities for storing the gas are necessary. Moreover, it is well to be able to transport and even to sell unrequired surplus. Developments in the use of this gas (for hardening oils, for various chemical processes, and, lastly, for autogenous welding) are favorable for the existence of such outlets.

It must be possible, at the stations, to inflate and replenish the balloons very rapidly, if they are to render the greatest efficiency. It is, moreover, the question of inflation which precedes, in determining the plants, the question of replenishing. In fact, for a large airship of 70,000 cu.m., with a total theoretical carrying capacity of 50%, the maximum unballasting (fuel, ballast, bombs, etc.) during a voyage, is 15 to 20 tons. On its return, therefore, it must receive a fresh supply of 15,000 to 20,000 cu m. of hydrogen. Under these conditions, unless for a particularly intense service, it is sufficient to hold in reserve 10,000 to 15,000 cu.m. of gas for immediate replenishing.

It is not exactly the same for inflating. It is assumed, in fact, that it must be possible to fill a large airship in 10 to 15 hours (The L-72 was filled at Friedrichshafen in 12 hours). At this speed, there is the advantage of not requiring so large a personnel and, above all, of facilitating the process of balancing, which might needlessly strain the frame of the balloon. It is, in fact, just so much easier to avoid a wrong distribution of the weight and lifting forces, as the means are more powerful for producing a rapid flow of gas into the balloon. It was probably for this reason that most of the German stations have a gasometer of 30,000 cu.m. and a battery of cylinders containing 30,000 to 50,000 cu.m. of gas under pressure, making a total of 60,000 to 80,000 cu.m., a volume practically equal to that of the largest airship.

It is then easy, as soon as an inflation is anticipated, to provide for completing the inflation from reservoirs, without furnishing the balance of the gas required at the end of the operation directly from the hydrogen works to the balloon.

It is, moreover, surprising how large a proportion of the hydrogen in Germany is stored under pressure. At first thought, it would seem, in fact, more economical to resort to the exclusive use of gasometers and thus avoid the expense of compressing, which absorbs about 0.5 HP per cubic meter. Nevertheless, the compressed gasplants of the German stations are interesting to consider. The containers are enormous cylinders 15 to 20 m. long by 1 m. in diameter, each holding about 1000 cu.m. of gas at 100 kg. They are stationary, on beds of masonry, and separated from one another by strong partitions. The whole plant is generally placed in a deep cave, sheltered from bombs. Lastly, in order to avoid explosive mixtures during the first filling, vacuum pumps are provided for removing the air from the reservoirs.

Due to these precautions, the reserve supplies in cylinders are little visible and little vulnerable. Their installation is rapid and easily modified. Lastly, there are no losses, such as may be very troublesome in using gasometers at long distances. Since there is little chance for the introduction of air into the cylinders, the purity of the gas is excellent. (The lifting force of the gas used in the L-72 was about 1188.)

Lastly, there exist in addition to the above described stationary plants, stores of portable cylinders similar to the French cylinders, and many tank cars, designed for running on ordinary railways, each holding from 1500 to 3000 cu.m. of gas.

The capacity of the hydrogen compression plants naturally depends on the productive capacity and exploitation conditions of their hydrogen works. It is not so much the inflations (relatively less frequent) as the replenishing and the needs of the service away from the central station, which determine the output of the compressors.

Ordinarily the 30,000 cu.m. of the gasometer would seem sufficient for the daily replenishing and for serving as a balance between the continuous production of the works and the irregular consumption of the balloons. In short, it is the needs of the outside consumers who, depending entirely on the compressed gas, determine the importance of the battery of compressors. At Nordholz the hourly output (1200 cu.m.) of the compressors differs but little from that (1000 to 1500 cu.m.) of the hydrogen producing works. The situation is about the same at Tondern (500 cu.m.). On the contrary, at Ahlhorn, where the gas production exceeds 2500 cu.m., the hourly output of the compressors differs but little from that of Nordholz.

Conclusion

We have reviewed the various organs required for the intensive exploitation of an airship station. They constitute altogether a veritable factory whose industrial character is clearly evident. As in every enterprise of this character, the cost of the first establishment is high. If, however, the plans are conceived on a large enough scale and methodically executed, the expenses incurred are rapidly amortized and the benefits of a favorable exploitation are assured. In this connection, it must be recognized that the Germans had a broad outlook in the organization of their airship stations.

ADMIRAL FULLAM ON THE ALABAMA TESTS

REAR ADMIRAL W. F. FULLAM (retired) discusses the recent Alabama bombing tests in a special despatch to the New York *Herald* as follows:

"The battleship Alabama was sunk at noon to-day (Sept. 26) by Martin bombers from the army air station at Langley Field. Four planes left the field, each carrying one 2,000 pound bomb, and three additional planes followed, each carrying two 1,100 pound bombs. The 2,000 pound bombs were dropped singly and the 1,100 pound bombs were released two at a time.

"The planes manoeuvered and fired from a height of 2,500 feet. The first 2,000 pound bomb struck the water near the ship abaft the beam. The Alabama was thrown over at an angle of 45 degrees and went down by the stern in thirty seconds, resting on the bottom of the bay with her upper works above water.

"Inasmuch as the six 1,100 pound bombs were dropped in pairs and the four 2,000 pounders singly there were seven distinct salvos in the attack, with four direct hits, a very big percentage. The last of the 1,100 pounders struck the Alabama amidships and completely wrecked the whole central citadel between the two masts. Both smokepipes were blown down and the foremast was bent over in a curve, with its top in the water.

"In her present condition the Alabama appears to be a much worse wreck than the Indiana, which has been a target for guns and bombs for many months. It is childish to attempt to discount this result by saying the Alabama is an old ship. No modern dreadnought could have survived this attack.

"As regards accuracy, the record of this last attack is remarkable in that all of the ten bombs struck within the danger zone—that is, within a distance that would have seriously injured the ship, either above or below water.

"The experiment to-day ends the bombing tests for the time being. The 4,000 pound bomb is being prepared at Aberdeen, however, and as soon as it is ready it will be sent to Langley Field. It is planned to send two, planes, one with the 4,000 pounder and the other with two 2,000 pound bombs, and drop them on or near the Alabama to give an idea of the probable effect of such an explosion upon the hull of a modern dreadnought. It will be the first experiment in naval history with a bomb of such size.

"Despite all efforts of conservative forces to minimize the importance of the Alabama experiments, it may be said that they corroborate the results of the tests against the German ships and furnish much additional information of the utmost value to the country.

"The officers and men at Langley Field, under the leadership of Gen. Mitchell and Col. Milling, have made a record of skill and devotion to duty that merits the highest commendation. The conditions have been difficult and discouraging in the extreme. Many skilled officers and men have been transferred or discharged of late and the available force has been so reduced that those remaining have been compelled to work night and day. It was the intention to sink the Alabama at night, but the necessity of completing all experiments at an early date and the physical impossibility of working the men night and day compelled a change of plan. Judging, however, from the success of the night tests with small bombs, we may be sure that the record of to-day's bombing with heavy projectiles would have been practically equalled at night.

"In closing it should be remembered that these important results that must logically and seriously affect our military and naval policy have been attained by the efforts of a few officers and men of the Army Air Service with old and inferior material, crude sights, and in spite of many obstacles and discouragements.

"The evidence is overwhelming that an efficient air force in conjunction with submarines, torpedoes and mines will suffice to protect the coast of the United States and its foreign possessions as well against invasion and against the attack of any hostile fleet that could be brought against this country."

THE RUMPLER 1,000-H. P. ENGINE

THE general arrangement drawings which are here reproduced show the main features of a 1,000-h.p. experimental aero engine which has been produced under the superintendence of Dr. Ing. E. Rumpler, of the well-known Rumpler aircraft concern.

It appears that as an aircraft designer Dr. Rumpler felt that existing aero engines had all been designed without a proper appreciation of the real needs of the aeroplane constructor, and in this instance he has set himself the problem of removing this drawback. He holds that the aero engine designers have been too rigidly obsessed by the fashions in favor with automobile engine designers, and that in their efforts aero engine designers have relied too exclusively on the use of superfine materials of extremely high strength to secure the necessary lightness.

It is, he holds, right and proper that the designer should employ these materials, but he should in the first place seek methods of construction and arrangement of parts such as to produce an engine fitted by its design for the special duties of propelling aircraft.

The 4, 6, or 8 cylinder in-line engine has many drawbacks for aero work. It is necessarily somewhat lengthy for the power developed, and hence encroaches on the space available for passenger accommodation or the like. The longitudinal moment of inertia is high, to the detriment of the manœuverability of the craft to which it is fitted.

To less and less extent the same disadvantages are alleged against the V and the three-row types of engine.

Neither does Dr. Rumpler consider the radial type, whether rotary or fixed, as ideal. The diameter of the engine is great, and therefore it is of unnecessarily high resistance. Also in the radial it is necessary to affix counterbalance weights to the crankshaft which represent useless load to be carried. Even if the radial be of the two-crank two-row type these balance weights are needed to some less extent, otherwise there is an unbalanced rocking moment set up.

In order to produce a really high powered engine which best compromises between the requirements of short over-all length and minimum cross-section resistance, which shall be of the least possible weight, and which shall have the most perfect balance possible, Dr. Rumpler has decided that it is necessary to combine the qualities of the radial and the in-line types.

Thus the Rumpler 1,000-h.p. engine is an engine with seven radial rows each of four cylinders, each plane of seven cylinders operating upon one of four crankpins of a four-throw crankshaft of the arrangement usual in four-cylinder vertical engines. This arrangement should—and it is claimed does—give the most perfect possible balance, together with low weight, small over-all length and a reasonable diameter.

The four cylinders of each line are held together by a block cylinder head, which carries the whole valve gear and the overhead camshaft for that line. This head block is removable for overhauls. Each ring of seven cylinders, with their water jackets, together with the corresponding ring of crankcase, appears to form a single unit casting, and the crankshaft bearings are carried on discs or spiders recessed into the crankcase segments.

Pistons are of compound structure, with steel skirts and aluminum alloy heads, and the big ends for each ring of cylinders are of the usual master-rod and wrist-pin type.

Four valves are fitted to each cylinder, all of equal size, and these exhaust to, or draw from, exhaust and inlet ports cast into the cylinder row head block.

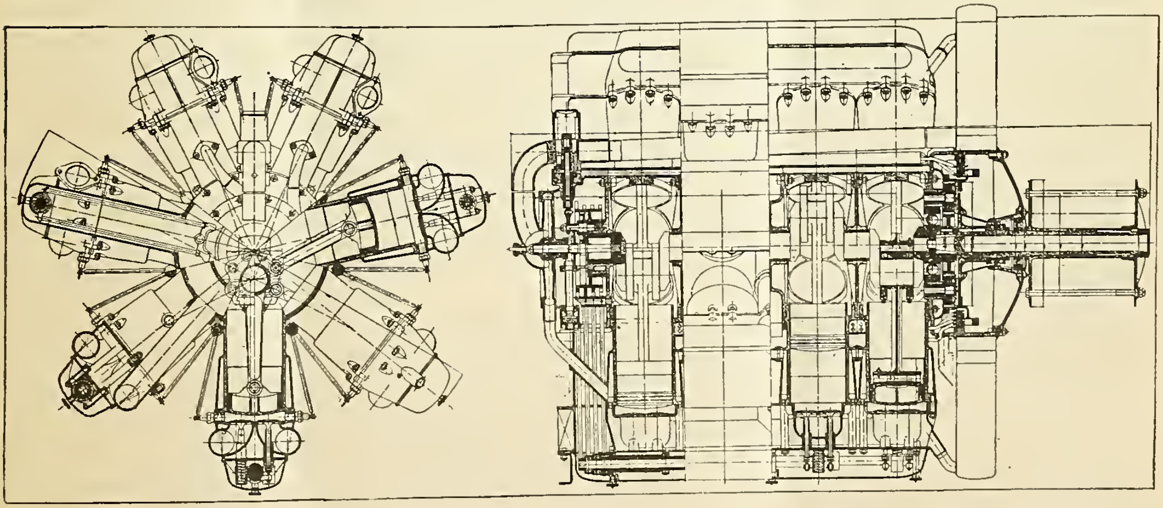
Although referred to as fitted with overhead camshafts, the engine is really fitted with a somewhat unusual type of valve gear. Four rings of cams driven by an epicyclic gear are mounted concentrically with the crankshaft at the end of the crankcase farthest from the airscrew. These cams are of the push-and-pull type, and each ring operates one pair of push-and-pull rods for each of the seven radial lines of cylinders. Thus to each row there are four sets of these rods, each coupled to one of a set of four concentric camshafts, one for each cylinder in the row. These shafts rock, instead of rotating, and appropriate rockers on their ends operate on the valves of the cylinders of each of these sets of concentric rocking shafts; the outermost is the shortest and controls the valves of the cylinder nearest the cam gear. The next inward one extends to the next cylinder, and so on. Although somewhat complex in appearance this gear is undoubtedly simpler than would be the necessary arrangements for driving seven separate overhead camshafts of the usual type.

The engine is fitted with an epicyclic reduction gear housed at the end of the crankcase. This is of the single-stage type, of large diameter, and fitted with seven rows of planet wheels.

Mounted on the exterior of the reduction gear housing is a circular radiator. One single centrifugal impellor at the far end of the engine pumps cooling water through seven radial water pipes to each line of cylinders. The water passes along each line and enters the circular radiator at its circumference opposite the end of the line, and flows radially inwards to an inner cylindrical water space, and thence by a common return back to the pump.

What is obviously a plunger oil pump is shown at the valve-gear end of the crankcase, and a high tension distributor can be discerned surrounding the epicyclic reduction gear. Also two plugs are fitted to each cylinder. The only particulars of dimensions, etc., available are that the bore and stroke of each cylinder is 140 mm. by 140 mm., that the output is 1,005 h.p. at 2,000 r.p.m., and that the reduction gear is of the ratio 2:1.

The engine is undoubtedly interesting and ingenious. But it is very doubtful whether 28 cylinders, together with 112 valves, and with the necessary accessories for operating the said valves, for illumining the 56 plugs, and for carburetting for 7 inlet manifolds can be justified even for 1,000 h.p. It is distressing to think of the probable language of a ground engineer faced with the task of giving this engine a "top overhaul."



Diagrams of the 1000 H. P. Rumpler Engine. Courtesy The Aeroplane

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

Indiana

Almost the entire state of Indiana is excellent flying country. The fields for the most part running north and south and east and west, and the highways being very pronounced every mile square. There is a strip running northeast from a little north of NORTH MANCHESTER, that is a little rolling and the section around the Lake regions is rolling. The section around LAFAYETTE is rolling. Southern Indiana is not so good. From SEYMOUR south, southeast and southwest, the country is hilly. The section west of a line between LOUISVILLE, KY. and INDIANAPOLIS, IND. and south of a line running between INDIANAPOLIS and TERRE HAUTE for the most part is rolling and hilly, particularly around BLOOMINGTON, BEDFORD, ORLEANS, etc.

Indiana for the most part is very good. Northern Indiana has a lot of fair fields. CHICAGO to INDIANAPOLIS and INDIANAPOLIS to DAYTON is good.

The country from LOUISVILLE, KY. to EVANSVILLE, IND., is dangerous to within a few miles of Evansville.

On the Chicago-Cleveland route, passing over BRYAN, OHIO, the land east from the Illinois line to a point ten miles east of GARY, IND., is swampy or with a scrub growth or sand dunes, unless swinging around more than five miles south of Lake Michigan. In the balance of the route over Indiana there are short stretches of territory of probably not over ten per cent of the distance altogether, on which a dead stick landing without damage would be difficult, but not impossible, due to rolling terrain and numerous groves. The weather across Indiana, over the Lakes region in particular, is quite difficult during rainy seasons, but very rarely impassable.

Iowa

Taking the whole State in general, there is very good territory to fly over, being filled with open fields in which to land in case of engine or other trouble.

Iowa is all good land to fly over. A great part of it is practically level to slightly rolling. In the southern part of the state the land is generally rolling. What is known as very rough farming country yet there are high clear ridges everywhere so that from 2,000 feet one can always pick one running into the wind, which offers a good landing place.

Iowa (along Air Mail Route)—same as Illinois, i.e., flat country, but mostly given up to farming. Fields large enough but mostly plowed, but here pastures make for better fields. Western half of run, country is more rolling but still very good.

In the vicinity of CHEROKEE the land is hilly but a man can find places to land within one mile of town, that is, one mile south. Of course, this community is entirely agricultural. The land around PAULLINA and SUTHERLAND is flat and dry and landing fields are plentiful.

At IDA GROVE the country is hilly, but there is a pretty good landing field 1½ miles southwest of town on the top of a hill. Generally speaking, this section is very hilly and landing fields are not plentiful.

At ARTHUR, Ia., is a splendid landing field at the south edge of town and the country is fairly flat and unobstructed.

At Lakeview, Ia., the land is swampy near the lake, but west of town there is a good landing field.

At HOLSTEIN, Ia., the country is flat and dry, and landing fields are plentiful.

At MARCUS, Ia., the country is flat and dry and landing fields are plentiful.

At MILFORD, Ia., the country is a little rough and north of town there is a landing field, but it is small and swamps at the north end.

At ANTHON, Ia., the country is hilly and landing fields are scarce, but at the south end of town there is a hay field, plenty large enough to make a landing, and the field itself is in good condition.

The air mail has a fine field at IOWA CITY, there is also a fine landing field on the north side of DES MOINES. The country from ATLANTIC, Ia., to OMAHA, Nebr., is a bit rough, but from a reasonable altitude a landing could be picked without trouble.

Along the Burlington R. R. (Chicago-Omaha route) as far as the Mississippi River, the country is perfect for landing, but from there until the Des Moines River is reached at OTTUMWA, Ia., the country is rather bad, but with plenty of altitude a safe landing would be possible. From Ottumwa the rest of the route is perfect.

From LINCOLN, Nebr., to ATLANTIC, Ia., one can land at any time from 1,500′. From Atlantic to DES MOINES, there is no fear of finding landing places. One can fly from Des Moines to OSKALOOSA and from there to Ottumwa, also landing at KNOXVILLE, Ia., and several towns south of the Des Moines River without trouble.

Kansas

LIBERAL to HUTCHINSON, level to rolling, some trees, farms, safe alt. 2500.

HUTCHINSON to WICHITA, gets rougher, more timber, air fair, farms still plentiful.

WICHITA to TOPEKA, gets hilly, more timber and objects, less emergency fields, alt. safe 4,000′.

TOPEKA to KANSAS CITY, little worse, about same.

Kansas is practically all excellent land to fly over. In the southern part of the State one needs to be careful about striking rocks in landing or taking off, but the fields are level.

In the eastern part of Kansas, south of KANSAS CITY and 50 miles west of the Mo. line central part very good, remainder good.

On a line from KANSAS CITY to WICHITA, KANSAS is good flying country. From Wichita and PARSONS, KANS., south to TULSA, OKLA., is pretty fair flying country.

Kentucky

That portion of Kentucky from CLARKSVILLE, TENN., to LOUISVILLE, Ky., is rolling and in lots of cases very hilly.

From DAYTON, Ohio, to LOUISVILLE, Ky., is extremely poor, especially after leaving HAMILTON, OHIO. From that place to within about twenty or thirty miles of LOUISVILLE does not contain even one good landing field in case of motor trouble. The country about one hundred miles Northwest of PADUCAH, Ky., is bad, continuing into TENNESSEE.

Country in square from PADUCAH to CAIRO and between MAYFIELD and COLUMBUS, very good—south of this in Southern Groves Country very poor—rolling and much washed, same as western Tennessee.

Louisiana

NEW ORLEANS to MERIDIAN, same as DEMOPOLIS to MERIDIAN, only more timber all way, few landing places, strip where there are none within twenty miles. Level, bad in spring, water everywhere.

NEW ORLEANS to MARSHALL, Texas, same as above, on nearing Texas line country gets hilly and rough. Timber and hilly Marshall. MARSHALL to TEXARKANA, Ark., a very poor strip, rough, timber, and lots of it.

Louisiana has some level flat country, but considerable amount of this is marshy. For the most part, the entire State of Louisiana is very bad flying country, with the exception of the extreme southern portion, the entire State being very wooded and marshy.

Between SHREVEPORT and HOUSTON, Texas, a pilot will find much wooded country, and places for forced landings few and far between.

East of river extremely rotten, miles of timber, cypress, swamps, etc. From Hammond south to the lakes one big cypress swamp. Northeast and northwest of Hammond all cut over timber. Good near BATON ROUGE for 15 miles.

No good landing fields near NEW ORLEANS.

Maine

Over the eastern corner of New Hampshire from NEWBURYPORT, Mass., to KITTERY, Me., it appeared to be very wet and swampy. Likewise the southeast corner of the State of Maine. After arriving north of BIDDEFORD, Me., there is some very good flying country each side of the Kennebec River for several miles. In this south central section of Maine there are plenty of very good fields with adjacent fields for use in emergency, some of the best fields in the state being in MADISON. In fact, there are very good fields in and around these towns: RICHMOND, WATERVILLE, SKOWHEGAN, MADISON, FARMINGTON, PITTSFIELD, DEXTER, DOVER, LEWISTON, EXETER and LIVERMORE FALLS.

CARIBOU, Me., PRESQUE ISLE, FORT FAIRFIELD, HOULTON and, in fact, the entire Northern Aroostook County, is most excellent and has large farm fields until a few miles south of HOULTON. Thence to DANFORTH, Me., fairly poor. Wooded areas mostly and few fields. Thence to BANGOR, Me. Here the entire distance is very dangerous, consisting mostly of large forests and even after striking Penobscot River the chances are poor, although some fields are available. In the event of forced landing without injury over this section, there would be a question of being hopelessly lost in these very large forests. BANGOR affords excellent chances.

Thence to MONROE, Me., fair. Thence to ROCKLAND, Me., quite bad. Vicinity of ROCKLAND, O.K. Lots of good fields here, but apt to be rather soft ground. Thence to Old Orchard Beach via BATH, Me., very good. Old Orchard Beach is one of the finest chances, but can be used only after tide is partly out. Hardly a chance for a fool to crack up there.

Thence to MANCHESTER, N. H., very good. Fields at Manchester not very good.

Maryland

From HAGERSTOWN to HARRISBURG via CHAMBERSBURG, CARLISLE and MECHANICSBURG, excellent flat landing fields all the way.

From YORK, Pa., to HAGERSTOWN, Md., O.K. part of the way, but approaches Allegheny ranges and rapidly becomes worse until it is really unfit for flying unless motor is sure.

Massachusetts

WORCESTER, ideal conditions, landing fields available should any engine or any other trouble force landing. If at an altitude of 2,000′ pilot could glide into a field at an angle, either BATTERY B FARM, HOLY CROSS COLLEGE GROUNDS or FAIR GROUNDS. The same applies to WORCESTER COUNTY.

SPRINGFIELD, ideal conditions, fields on outskirts include aerodromes at Eastern Aircraft Corp.

BOSTON, landing fields very poor, except in suburbs.

There are hundreds of fields in this state, connected with one another, over which a pilot could safely fly. GREENFIELD, drawing a line from KEENE, N. H., through GREENFIELD, Mass., through RUTLAND, Vt., the land covered is a good flying route, if reasonable altitude is kept.

From BOSTON to PROVIDENCE, R. I., one passes over country fairly evenly sprinkled with landing fields. Few should be used except as emergency fields. Among them is the Aviation Field at Rhode Island in PROVIDENCE. This is an excellent field.

BOSTON, locality, country rugged, south toward QUINCY, BRAINTREE, i.e., south shore toward CAPE COD. Neck of CAPE under irrigation, cranberry patches. Several safe landings for seaplanes. Air fair along coast line back toward BOSTON from CAPE, NANTASKET, hilly to rolling; Hull, lagoon, hilly; Paddocks Island, large rolling hills. HOUCHS NECK, Quincy Bay, the same. SQUATUM, Mass., old flying field, fair, air fair, dangerous over water. Hot weather, accident 1912, also balloon accident Quincy Bay 1911, "Stafford," cause bad air, hot weather, over water. Air conditions rugged to rough at Marblehead, good seaplane harbor, home of Burgess Company. All along this coast danger of "squalls" in summer, very sudden.

On flight across Massachusetts from SPRINGFIELD to WOONSOCKET, R. I., from an altitude of 7,000′ to 8,000′ no field fit to land in was observed. All woods and hills. Flying north from Woodsocket to LOWELL, Mass., and out the Merrimac River to NEWBURYPORT, there are plenty of suitable landing fields. Over the eastern corner of New Hampshire, from Newburyport, Mass., to KITTERY, Me., it appears to be very wet and swampy.

From FRAMINGHAM, Mass., to Connecticut the country is rough and many woods cover the ground.

From GREENFIELD, Mass., up to CONNECTICUT RIVER as far as CHARLESTOWN, N. H., there are any number of excellent fields to drop into that were probably once a part of the river bed. For a distance of perhaps three or five miles on either side of the river there are good places to land in. On the way to PETERBOROUGH, N. H., from GREENFIELD, Mass., there are a few poor stretches about ten miles from MT. MONADNOCK, both on the GREENFIELD side and the PETERBOROUGH side. In the general direction of KEENE, N. H. (from Grenfield), there are good fields.

Taking a direct course from ORANGE, Mass., to BOSTON, with the exception of the first ten miles, a pilot should not have any real cause to worry, as there are numerous fields along the entire course which would make good landing fields. The first ten miles of the course are extremely dangerous, being very much opposed to aviation in all respects, chief fault being only one field fit to land in; also a low altitude being troubled with air currents from the river. This, of course, applies to low powered machines.

From MANCHESTER, N. H., to WORCESTER, Mass., is very good. Excellent field there. Thence to SPRINGFIELD, very good and excellent field there. Thence to BRISTOL, Conn., fairly good and excellent field there, but on proceeding to DANBURY, Conn., conditions become not so good and hills increase.

Michigan

The country of Southern Michigan is rather swampy and there are many bad places in it, but if an altitude of 2,000 feet is kept a pilot would be in gliding distance of some solid ground. The fields in Michigan are generally small and lined with trees. It is said that more crashes occur here by motors failing on taking off than in any other way. There are spots that are absolutely level as prairie and have large fields. A good deal of the country is slightly rolling, but there are always fields which can be used in case of emergency. There is a section of territory extending about ten miles north and south between CASSOPOLIS and THREE RIVERS where a forced landing would mean a crack-up, as there is absolutely no place to land. The section of country around HILLSDALE is very hilly, but a landing can be effected.

Michigan on a line south of BAY CITY is very good and landing fields very numerous.

Within thirty miles north of GRAND RAPIDS and most of Southern Michigan is farm lands which are possible not only to land in, but also to take-off.

There are wide portions in Northern Michigan where pine lands make it extremely dangerous because of no landing fields, but these can be avoided by following the Pere Marquette and also the G. R. & I. Railroad as far north as PETOSKEY, and there are available landing fields all the way up.

Minnesota

Land almost anywhere east of MOORHEAD, Minn., is good for 20 miles, then country becomes rolling and hard to find landing fields. Along central part of Minnesota, very good, and in flying from MINNEAPOLIS to FARGO best route to follow is along the Great Northern Railway, then MORRIS and LITCHFIELD, Minn.

MANKATO to TRACY, and vicinity, country is fairly smooth and the air conditions are real good, generally speaking. There are quite a number of lakes around here, and the landing fields are very good and fairly large. The air conditions are very similar to those at MAICH FIELD near RIVERSIDE, Cal., though the air is not so bumpy.

For a distance of one hundred miles west of MINNEAPOLIS, the presence of many lakes and considerable timber makes the possibility of forced landings a little more complicated. However, a pilot with average experience should have no serious difficulty in effecting safe landings if necessary.

Minnesota offers an excellent flying country, with large fields of wheat and oats and a great deal of pasture or meadow land, which makes an ideal aeroplane landing field. Under the worst conditions (those being growing grain) the worst one can look for upon being forced to land in one of these fields is the breaking of his propeller, and more often there is no trouble at all from a forced landing in a grain field, the only inconvenience being that at times the plane has to be hauled out on account of the possibility of destroying a great deal of grain, should one try to taxi around. This territory comprises the entire Red River Valley, which extends from the Canadian boundary to the Central Western part of the State and is a belt that runs north and south through the State and varies from 75 to 150 miles in width. The central part of the State and the southern and southwestern parts are made up of fine farming lands, which offer numerous pastures, thus making ideal spots for the aeroplane to land. There is a great deal of dairying in the southern part of the State and, of course, this helps the landing grounds. The northern and northeastern part of this state is covered by timber land, but there are enough clearings in this country so that it has been possible to fly planes almost everywhere without the slightest trouble. There have been no fatal accidents on account of landing in the trees in this part of the state.

A flying boat would be very popular on account of the thousands of lakes. On the whole the risk of an aeroplane flying in this state is a very good one.

The northern part of Minnesota has practically no emergency landing fields and is considered very dangerous land over which to fly. South of the line of ST. CLOUD will be found a pretty good flat farming, except along the Mississippi River, where it is quite rough. There are very few places along the river, however, where you cannot set a ship down and get it off. There are ten thousand lakes in Minnesota, and a flying boat could travel almost anywhere about the state and keep within gliding distance of water.

The western half of Minnesota, except in vicinity of Minn. River, good; near MINNEAPOLIS, poor; west of Minneapolis, except first 30 miles, good; S. W. and S. of Minn. River, all very good.

In northern Minnesota there are steady miles of large jack pines. One can fly for an hour and a half without seeing a passable landing field. Below central Minnesota are lakes and swamps by the hundred, country rough around MINNEAPOLIS and ST. PAUL, with many lakes.

From FARGO, N. D., to MINNEAPOLIS, good for first two hundred miles, bad from then on.

In and about TRACY and its vicinity, the country is very favorable to flying. There are a few hills, none of which are very high, a few lakes and some swamps. The lakes and swamps, however, ought not to give any pilot any difficulty providing he is flying at an altitude of 1,500′.

The country in and about TRACY and vicinity is composed mostly of pasture and farm land. In the summer one might have to contend with corn fields and grain fields, and of course, would at all times have to contend with fences and with telegraph and telephone wires. The conditions outlined as pertaining to TRACY and vicinity are true of the country surrounding Tracy for a considerable distance.

In and about NEW ULM and MANKATO one has to contend with the bluffs surrounding the rivers. Again, if the pilot has sufficient altitude he ought not to have any difficulty in making a forced landing. There is one hangar and a very good landing field at TRACY and it is a good field to make and land at on any cross-country flight.

At JASPER, Minn., there are piles of rocks scattered around, but at the east edge of that town is a hay field or pasture suitable for landing.

At BROOTEN the land is fairly flat and there is a good landing field at the southwest edge of town.

Between BROOTEN and PARK RAPIDS, MINN., the land is flat but is swampy and timbered, and landing fields are somewhat scarce.

At ORTONVILLE the land is very hilly and about the best landing field is a field two miles north of town.

At PARK RAPIDS, Minn., the country is flat but is swampy and abounds in forest and scattered trees and landing fields are not plentiful, but at the west side of town is a race track where one can land, but has to be careful because there are bumps in the field.

Between PARK RAPIDS and BEMIDJI the country is very hilly and covered with forests.

From CHICAGO to MINNEAPOLIS-ST. PAUL over LA CROSSE, Wis., the route lies over fairly level and open territory as far as the WISCONSIN RIVER, from there on northwest the country grows rapidly rougher and with heavy timber till the last fifty miles out of LA CROSSE has only scattered possible landing fields. From LA CROSSE up the river valley or over the highlands to the west of river possible landing fields are available from an altitude of two to three thousand feet. The territory from the WISCONSIN RIVER northwest has days when low fog and rain make it impassable but these days are actually not numerous. In winter time this route suffers from very cold weather and blinding snow storms, some of which are practically impassable. This route does not suffer from prohibitive winds.

Field of Curtiss Co., between ST. PAUL and MINNEAPOLIS, north of river near Fair Grounds, Mail Field, south of river with big cement race track. Country directly west of Minn., rather poor for 30 to 50 miles, then good on west. North of this bad place it is good as far as Souk Centre. To the N. E. it gets more wooded, but west and N. W. towards BRECKENRIDGE it is good.

WHAT AIRSHIPS CAN DO

In a special article in the London *Observer,* Major C. C. Turner, the well-known British aeronautic authority, presents some timely thoughts on the subject of airship transportation.

Excepting the passenger airship services of Germany before the war there has been no test of airship line possibilities. Germany is favored by nature for airship work, moreover; and in those services there was no strict requirements as to speed and daily regularity. On the other hand, the ships engaged would now be regarded as obsolete. The services were run with ulterior war objects, and for the maintenance of a fleet and the training of personnel. They were successful in so far as no passengers were lost or injured.

With the victory of the Allies, airship work by the Germans, who had most of the experience, came to an end, and it was left to Great Britain, France, and Italy. In all these countries, however, it has been half starved.

The R-38 must not be taken as an example of the best that could be done. It was designed for war of a special character and conditions, and it is highly probable that if the Germans had been presented with the same proposition they would have designed something very like it. The disaster can hardly fail, however, to lower British airship prestige; and it would not be surprising if America should now make a fresh start from the pure Zeppelin model. It is said that negotiations are now in progress for a Zeppelin of 3,500,000 cubic feet. A very different ship than the R-38 would have been built in this country for an airship passenger line, for which it is certainly not necessary to have an altitude capacity to 25,000 feet.

During the trials of the R-38 she attained a speed of 50 knots, or 57 miles per hour, with only three-quarters of her power; and this marks an advance in the most important direction, and shows there is no inherent impossibility of improvement of the speed of airships. The speed hitherto has been disappointing, because it has had to be sacrificed for fuel-economy, and to some extent also to structural requirements. Like everything else mechanical, the airship embodies compromises. But it must be admitted that the theoretical maximum speed of no airship type has been obtained, except briefly and on rare occasions. Thus, the R-34 in crossing the Atlantic, although the engines were only once worked "full out," and for nearly all the time the voyage was made at lower than "economical" speed, consumed far more petrol than was anticipated, and reached New York with only ten gallons left. The air speeds in the log show that at the start, with all engines working, 55 knots were "made good"; there was a following wind of 25 m.p.h., so that the air-speed was about 41 m.p.h. Thereafter the following air-speeds appear in the log, the figures being here converted into miles per hour:—43½, 45, 36½, 34, 41, 41, 39, 41, 41, 24.

German Criticism

The capabilities as well as the design of airships must be put to very searching criticism, for it is only after this preliminary that progress will be attained. In Germany the voice of criticism has not been silent, and it is asserted that no sure method exists of determining the amount of ballast necessary for a voyage of any considerable length, and that so long as the discharge of ballast is necessary to compensate for atmospheric variations long journeys will always be a matter of luck. Some of the accidents are, it is said, traceable to this cause. It is also pointed out that the "useful load" estimates are always based on sea-level figures, and that at 10,000 ft. it is only about two-thirds as much (as explained in these Notes last week). Yet on long journeys an airship, apart from the need to cross mountains, would have to range up to 8,000 or 10,000 ft.

Of eighty-three Zeppelins employed during the war thirty-four were shot down and destroyed, two were accidentally destroyed on entering or leaving sheds, thirteen caught fire accidentally, ten were destroyed in emergency landings, four owed their loss to failure of engines, one was destroyed by lightning, and one broke adrift and disappeared. It is remarked that of the thirty-four brought down by enemy action, some would otherwise have been lost from the other causes specified.

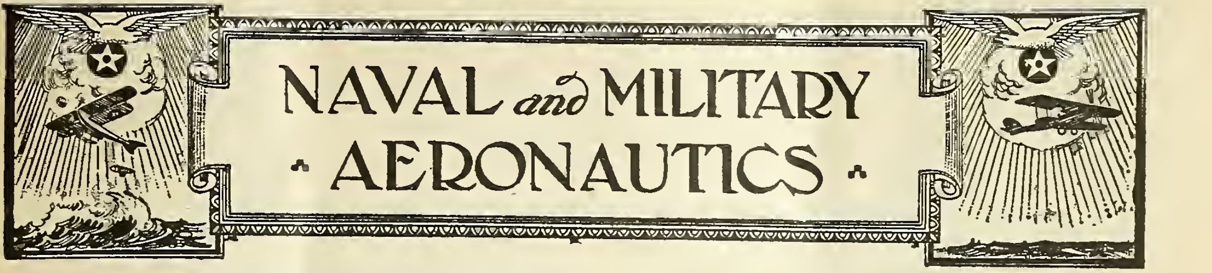
Some of this criticism is met by the mooring mast, which makes it easier to berth an airship and, being comparatively inexpensive, can be provided at numerous points.

It should be explained that an airship, in addition to the lift provided by its gas, can be given a certain amount of "dynamic lift" by means of its speed and the operation of its elevators; but ascent, by whatever means, involves expansion and loss of a certain amount of gas, whilst descent suddenly below static equilibrium may impose exceptional strains on the structure owing to diminished interior pressure.

Solid Claims

The airship, being capable of remaining aloft for long periods, does not need such high speed as the aeroplane. It need not make a straight course, but can avoid unfavorable currents and take advantage of helping ones to some extent. More experience is admittedly required, and accurate wind forecasts. With these much will be possible, for it is very rarely that a wind blows even for a short period over a front of as much as 1,000 miles. It is, however, a fallacy to suppose that there is always a favorable current at some altitude; and even if there were, an airship cannot do much ascending or descending without loss of ballast or gas. Again, it is fallacious to take into account merely the average strength of the wind in any region. Thus, one is told that the average adverse wind in the North Atlantic is only ten miles per hour; and that "therefore an airship of 50 m.p.h. can——," and so on. What must be taken into account is the number and incidence of the days when the wind exceeds a certain velocity.

But to point to the advantages of airship travel is really unnecessary; it is universally understood. There is one point, perhaps, that has not yet been widely grasped, and that is the beneficial reaction it would have upon steamship services. Steamship travel will both be cheapened and increased by airship services. For one thing, high-speed passengers will not have to be catered for, so that coal will not have to be burned extravagantly. Steamships, therefore, could be built on economical lines for ordinary passengers and cargo; and steamships will be one-class boats, thus getting rid of distinctions that become irksome on long voyages, and also making for efficient and economical management.



NAVAL and MILITARY AERONAUTICS

Construction of ZR-1 Progressing

Washington—Loss of the giant British-built airship ZR-2 with many lives on her trial trip in England has not thus far caused any change in plans for the ZR-1 now building for the navy. The two designs were so dissimilar, it is said by navy officials, that the wrecking of the ZR-2 carried with it no lessons so far as now known to be woven into construction of the ZR-1 as a safeguard against similar disaster to that vessel.

The ZR-1, it is explained, is the American navy's pioneer project in airship construction of the rigid type and the vessel follows very closely the design of the German Zeppelin L-49, captured intact in France during the war. Modifications to permit installation of American made propelling engines and a few other changes were necessary, but navy officials regard the ZR-1 as practically a reproduction of the L-49, which was proved by the Germans as a safe and reliable craft with all stresses and strains demonstrated in actual flight under varying conditions.

It was the purpose of the navy experts to make the L-49, which was almost the last word in German war experience construction, the starting point for American development of lighter-than-air rigid war craft. On the experience gained in operation of the ZR-1 it is planned to base future improvements or increases in size.

The ZR-2, on the other hand, represented the last word in British engineering progress over German originals, and the disaster to the British-built vessel officers here feel, only tends to confirm the decision to attempt no unexplored field of construction in turning out American Zeppelins, but to proceed from one well established model to the next improvement slowly and so on, step by step, to whatever the ultimate lighter-than-air cruiser of the future is to be.

Construction of the ZR-1 is said to be going slowly by reason of reduced appropriations for the navy this year. Practically all of the duralumin for girders of the ship's framework has been produced and is now in process of fabrication into the latticework frame members at the Philadelphia aircraft plant of the navy; contracts have been let for the eighteen gas bags which will furnish the lifting power, and the keel of the ship will be laid within a few months at the Lakehurst, N. J., hangar built to house both the ZR-1 and ZR-2.

The frame members are being cut and assembled at Philadelphia, to be knocked down when complete and shipped to Lakehurst, where they will be reassembled and placed in the ship.

The gas bags are designed for either hydrogen or the new non-explosive but highly expensive helium gas discovered during the war. At present plans call for the use of hydrogen because of the excessive cost of producing sufficient helium to fill the bags to their full 2,000,000 cubic feet capacity.

The ZR-1's 645 feet in length and 78 feet in diameter practically duplicate the standard German practice, as shown in the L-49, which was produced after the Germans had operated some 140 aircraft of the Zeppelin characteristics in actual service. In speed, however, the American craft is expected to exceed the sixty-mile maximum of her German prototype, due to use of higher power. Present plans call for the use of six Liberties, each in a separate car, as against the original plan for five engines, two of them driving the stern propeller and mounted in the after car. The motors were designed to deliver 400 horsepower each for aeroplane use, but for employment in the ZR-1 will be reduced to 320 horsepower each, with a consequent improvement, it is said, in economy and reliability of operation.

While the ZR-1 will have virtually 700,000 cubic feet less gas capacity than the ZR-2, her lift is expected to equal the 56-ton pull of the British trans-Atlantic R-34, and to be about twenty-seven tons less than the ZR-2. The American designers have been unable as yet to make what they regard as accurate calculations as to the useful load—the tonnage in excess of her own weight equipped for flight—the new ship will be able to carry.

Drop 4,300-Pound Bomb

Baltimore—The largest, fully charged demolition bomb ever made was exploded September 30 at the Aberdeen Proving Grounds by the Army Aviation Service with prominent officers of the navy and army as witnesses. The bomb weighed 4,300 pounds and was dropped from an altitude of 4,100 feet. It landed within the area marked off and left a crater 100 feet in diameter by 30 feet deep.

The observing party was on an elevated platform, 1,500 feet from the spot. They felt no unpleasant sensation and nearly all agreed that the effect on their eardrums and nerves was not severe. Marshland was chosen for the test.

Captain Carolin was the pilot and Sergeant Smink and Corporal Avariet the bombers. A specially constructed rack device held the bomb, and when the bombers reached the desired altitude the gentle pull of a lever released the big missile. It was about 13 feet long, 2 feet in diameter and colored red with a yellow tail. The coloring was to enable the observers to study the motion of the bomb.

Changes in Navy News Section

Lieutenant Commander Wells Hawkes, U.S.N.R.F., has been directed to report to Secretary Denby with a view, it is believed, of taking charge of the Navy news and information section. Mr. M. H. McIntyre, a Washington newspaper man, who has been in charge of the Navy news section for over three years, severed his official connection with the department on September 1 and has inaugurated a news service covering special Navy news and photographic features. Mr. McIntyre joined the committee on public information in 1918 and has rendered valuable service to the department in the dissemination of news. He has been of great assistance to the newspaper men who "cover" the Navy Department.

ZR-2 Disaster Laid to Faulty Designs

Lack of proper co-operation and supervision when designs of the dirigible ZR-2 were first drawn, and the later failure to submit the changes in design to closer scrutiny, are blamed for the disaster of the big airship in the report of the Air Ministry's Board of Inquiry, which was issued October 7.

It was simultaneously announced that the Admiralty was beginning an inquiry on its own account to determine just what happened when the airship's designs were first drawn under the stress of war, and the course of events until they were turned over to the Air Ministry, October 1, 1919.

Commander Dyer, U. S. N., who represented the United States Government during the building of the airship, sat with the inquiry board as "in attendance," but did not sign the report. The report reveals very little not already published, but places the blame, if blame there was, upon the "pioneers"—most of whom perished in the disaster—responsible for trying to turn out an airship to beat the Zeppelins under England's constructional facilities.

In describing the accident the report says that under the tests the airship was made to execute sharp turns at forty-five to fifty knots, which brought the breakdown between the ninth and tenth frames. It says that the fire started from sparks caused by broken electric "leads" coming in contact with broken petrol "leads," the fire spreading throughout the keel, setting off the oxygen.

The electric installations were all in the forward part of the ship. No fire broke out in the after part of the ship, in which four of the five survivors came down safely. Then follow these significant paragraphs:

"That the requirements as to the maximum height and speed, together with the limits of length imposed by the only available construction sheds, necessitated the utmost economy at Hull in the matter of weights and materials. Many new features were introduced in the design, and it appears evident that in some cases there was a lack of vital aerodynamical information as to the effects of these modifications on the strength of the structure.

"That having regard for the great differences in requirements between His Majesty's airship R-38 (the British name for the ZR-2) and previous British airships, the design should have been examined and discussed by an official and competent committee before actual construction was commenced. There is no evidence to show that this was done, though the opportunity arose after the armistice, when information as to the details of ships built elsewhere became available.

"That the system by which both construction of the ship and the inspection work was centred under one head, as was the case at the Royal Airship Works at Cardington, is unsound.

"That, although there can be no doubt that efforts were made toward the end to complete the ship in the shortest possible time, there is no evidence that the work on the hull or structure suffered."

FOREIGN NEWS

The Soviet Acquiring Airships

According to the *Epoca*, the Russian Soviet agent, Vorowski has purchased two of Italy's airships, which are to go direct to Moscow.

German Aeroplanes for Sale

According to the Amsterdam correspondent of *The Times*, advertisements have appeared in the Dutch press, offering for sale 36 new German aeroplanes. The machines are stated to be equipped with 200 h.p. Benz and 120 h.p. Mercédès engines.

Record of the Fokker European Airlines

The following statistics of the Fokker European airlines are immensely interesting as demonstrating the safety and reliability of aerial transportation:

Line	Route in miles	No. of Trips scheduled	No. of Trips carried out	Miles Flown	Accidents involving injury to persons or loss of freight
London - Rotterdam - Amsterdam V. V. Period: Apr. 14—Aug. 28.......	265	243	230-95%	61,000	nil
Rotterdam - Amsterdam - Bremen - Hamburg V. V. Period: Apr. 14 Aug. 1.	280	186	176-95%	50,000	nil
Danzig - Konigsberg - Memel V. V. Period: Apr. 1—Aug. 1.........	180	242	233-96½%	42,250	nil
Extended during August ro: Danzig - Konigsberg - Memel - Riga V. V. Period up to Sept. 1.....	270	54	54-100%	13.350	nil
				166,600	

More German Soaring Records

Following on Klemperer's 13-minute flight on August 30th, on September 6th Herr Martens, flying the Hanover (Pröll) monoplane, put up a new record by leaving Wasserkuppe and remaining in the air for 15 minutes 40 seconds, and covering a distance of 7.2 km. (This distance appears to be a straight line measurement, and not as in the Klemperer figure of 9.6 km. a flight path measure.) The wind was between 5 and 7.5 metres per second, and for 11 minutes 30 seconds the machine kept at or above the level of the start. A landing was made near Batten, 410 metres below the starting point.

On September 5th, a Herr Harth made a flight of 21 minutes, landing only 12 metres below the start, and on the 6th the same pilot flew 22 minutes, finishing with a dive and crash.

University Courses for British Officers

In order to afford R.A.F. officers facilities for advanced technical studies, arrangements have been made for a limited number of officers to attend certain courses at the principal Universities in the country. These courses have been instituted mainly to enable officers to qualify themselves for technical duties in engineering, wireless, navigation research, and other branches.

The courses are as follows:

(a) Special Course in Engineering subjects at Cambridge University.

(b) Post-Graduate Engineering Course at the Imperial College of Science and Technology.

(c) Special Course in Aeronautical Research. This course is also held at the Imperial College of Science and Technology.

(d) Courses in Mathematics and kindred subjects at Universities in the United Kingdom.

Whilst attending these courses officers will receive full pay and allowances of their rank and will be required to pay all personal expenses. Those taking course "D" will also be called upon to pay all University and other fees, and those taking course "B" to contribute £20 towards the fee payable to the College.

An officer will not be eligible to attend a University course unless he holds a permanent commission, and fulfils certain other conditions.

The South African Air Force

The S.A. Air Force, with headquarters at the Swartkops Flying Station, Pretoria, has two hangars, six machines and six trained pilots.

There are at Pretoria now eighty commandants from various parts of the Union undergoing military training and they are taking a great interest in the air depot. They were agreeably surprised when it was explained to them that 112 aeroplanes with every sort of spares and equipment had been made a free gift to the S.A. Air Force.

In October, a committee under the Minister of Defense will select additional personnel. They have already had 1,500 applications for the ten flying officers' appointments and 10,000 applications for enlistment.

Commissions, which are for three years, and may then be renewed, are available from the ranks. The selected candidates will receive six months' training at a military establishment, six months at the air depot, six months at a flying station and six months actually learning to fly.

Pilots must be between 18 and 30 years of age.

In addition to Pretoria there will be stations at Bloemfontein and Maritzburg. It is proposed to use aircraft in co-operation with the police in the Transkei and Swaziland.

The Commandant S.A. Air Force is Colonel Sir Helperus van Ryneveld, K.B.E., D.S.O.

Meeting of the F. A. I.

The next meeting of the International Aeronautical Federation (F. A. I.) will take place October 26 to 28 next, at Madrid, Spain. The meeting will be attended by delegates from the eighteen countries which possess active affiliated aero clubs, namely, Argentine Republic, Belgium, Brazil, Czecho-Slovakia, Denmark, France, Great Britain, Italy, Japan, Netherlands, Norway, Poland, Portugal, Spain, Sweden, Switzerland, United States and Uruguay. Two of the affiliated national bodies, those of Egypt and Russia, are considered inactive, while three ex-enemy countries, Austria, Germany and Hungary, were excluded from the F.A.I. during the late war.

Among the subjects which will come up for consideration at the Madrid meeting will be the re-admission of the ex-enemy countries, particularly of Austria, which is urged by the affiliated bodies in Spain, the Netherlands and Sweden. Requests for affiliation have been received from Finland, Haiti-San Domingo, and Shanghai. The provisional admission of Chile and China decreed by the previous meeting of the F. A. I., on January 9, 1921, will be submitted to ratification.

British Aerial Transport Figures

From May, 1919, to March 31, 1921, 63,975 civilian aeroplane flights were made in the United Kingdom, averaging 19 minutes per flight. The planes flew a total of 1,593,700 miles in those 23 months. More than 170 tons of freight and 110,388 passengers were carried. There were 2,315 departures for the Continent and 2,191 arriving planes in Great Britain. In that period imports totalled in value 818,553 pounds sterling. Exports aggregated £402,776; 84,607 letters were transported from November, 1919, to March 31, 1921. From May, 1919, to March 31, 1921, there were eight fatal accidents, 18 non-fatal accidents, and 20 accidents in which none was injured. Fatality rate per thousand passengers was 0.10. Non-fatal accident rate was 0.14 per 1,000 ppassengers.

French Air Transport Figures

It is reported that civilian air lines in France imported 2,041,400 and exported 660,200 francs worth of merchandise during the first quarter of this year; 22,000 letters were carried in the same period. Between March, 1919, and March, 1921, the fatality rate from accidents was 0.10 per 1,000 passengers. Injuries rated 0.14 per 1,000 passengers. The French Commercial Air Company carried 6,697 passengers in 4,428 flights over 1,590,000 kilomoters.

New German Combine

It is reported that the Aero-Union A. G. Berlin has just been founded with a capital of 12,500,000 marks, of which the "Allgemeine Elecktrische Gesellschaft" are taking over 5,000,000, the Luftschiffbau Zeppelin G. M. b. H. Friedrichshafen, 2,500,000 and the Hamburg-American Line 4,998,000 marks. The objects of the company are air transport at home and abroad, sale of aircraft and operation in all lines.

German Air Transport Figures

It is reported that from February 5, 1919, to November 26, 1920, German aeroplanes covered approximately 1,000,000 kilometers and conveyed 5,545 passengers, 453,000 kilos. of freight, and 35,000 kilos. of air mail.

Dutch Operations

Dutch newspapers state that commercial aerial transport of both passengers and freight has become so popular that the lines will continue to operate this winter.

Vickers Activities

There is quite a lot of activity as regards aircraft at the Brooklands works of Vickers Ltd. just now.

The "Viking IV" (450-h.p. Napier "Lion") has completed her flying and water tests, and has given great satisfaction. The water tests were carried out on the Solent, with Capt. Cockerell as the pilot. There are no fundamental differences in design between the "Viking III" and the "IV," but there are alterations and modifications in the detail design. The wings are of slightly larger span and chord. Instead of the service petrol tank protruding above the centre section of the top plane, it has been redesigned to form part of the centre section, with an improvement in appearance and a lessening of head-resistance. The beam of the hull is greater, so that the cubic capacity is slightly greater. The wing floats and undercarriage struts have been redesigned, and the engine is fitted with a very efficient self-starter, which started up the "Lion" on the first turn of the handle four times in succession during a recent test. The tail surfaces are the only prominent feature which remain as before. Some "Vikings" are fitted with folding and others with non-folding wings.

Two "Viking IVs" have been ordered by the Dutch Government for use with the Dutch Navy, and it is understood that they will be sent to the Dutch East Indies, where they will be used for "spotting," etc., with ships.

Their range at about 100 m.p.h is 900 km. (about 560 miles), and their top speed is a few miles per hour more than 120. These machines carry wireless, and are fitted with two Scarff gun-rings, one fore and one aft of the wings.

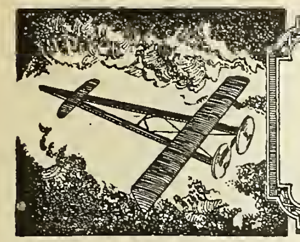
Another "Viking IV" has been ordered by the French Government (or rather the Section Technique), and is the only machine destined to be used for civil purposes that Vickers have in hand. This machine has a neatly arranged cabin for passengers. The three machines mentioned will be tested very soon, and duly delivered.

R. A. F. "R.38" Memorial

The Air Council, in deference to representations which have been made to them, have approved of a fund being opened in the R.A.F. to provide a memorial in the Western Cemetery at Hull over the grave of the officers and men who lost their lives in service on the "R.38."

France to Have a Soaring Competition

Encouraged by the success attained by the Germans in the Rhön Mountains, the French sporting journal *l'Auto* announces that it has decided to organize a soaring and gliding competition in France during 1922. The rules and dates for the competition will be announced shortly.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

Aero Congress Purchases Models

TWO models, a scale model of the Curtiss "Jenny," and a K. O. G. "A" type racer, designed and built by C. H. Fastje, have been purchased for photography and advertising work for the International Aero Congress, to be held in Omaha next month.

As Omaha is only 75 miles from Dennison, Iowa, where Mr. Fastje resides, the models were delivered by automobile, so that it was unnecessary to take them apart for shipment.

Mr. Earl W. Porter, president of the Aero Club of Omaha. discussed the subject of an exhibition of models. It is expected that prizes will be awarded for workmanship, etc., and that various awards will be given to builders exhibiting their own models. The compressed-air motored model and the Curtiss triplane scale model, recently described in AERIAL AGE, will be exhibited by Mr. Fastje.

Before delivering the "A" type racing model, it was practically rebuilt and 16-inch propellers were used. The model as it now weighs is a couple of ounces lighter, and consequently its flying qualities are improved. For four or five days the model was flown with interesting results. The cutting down of the weight made it possible to fly the model as far on 75 per cent of the number of revolutions previously required for the same distance.

Woods Used In Aircraft Construction

(Concluded from last week's Issue)

Cottonwood

Common cottonwood is known also as big cottonwood, yellow cottonwood and Carolina poplar. Swamp cottonwood is known also as black cottonwood, river cottonwood and swamp poplar.

These species are low in strength properties, but light, tough, and fairly easy to work. It is used chiefly for ply wood.

Red Gum

This species is also known as satin walnut, sweet gum, and liquid amber. Red gum is also another approved material for aeroplane ply wood and is used considerably for various commercial purposes. It is a promising wood for future use in the aircraft industry.

Mahogany

The principal varieties are Central American, African, and Philippine mahogany, the last species sometimes called Tanguile or Bataan mahogany. Red Lauan is sometimes called Philippine mahogany.

The true mahogany is a most excellent wood for propellers and has been used very extensively for that purpose. Selected pieces of the African variety are as satisfactory as true mahogany, but on account of the wide variation in strength properties between the different species and between different lots of lumber from the same species, together with the difficulty of distinguishing the different species by inspection, African mahogany has not been popular as propeller wood. The Bataan mahogany from the Philippine Islands has also found a limited use for propellers.

American and African mahoganies make excellent ply wood, but will hardly be used on a large scale because of their high cost as compared with native woods which are quite as satisfactory.

Spanish Cedar

Spanish cedar (also called Indian mahogany) is light, durable, easily worked and strong for its weight. It makes excellent ply wood and has been used to quite an extent for the thin planking for flying boats and pontoons or floats.

It is interesting to know that in the United States, more than 99 per cent of the cedar used goes into the cigar-box industry.

General News Notes

A small sport plane is being designed by sailors of the U. S. Naval Air Station at Coco Solo, Canal Zone. This machine, upon which work will soon be started, is to be provided with a three-cylinder, 60 H.P., air-cooled Lawrence engine.

An automobile, driven by an air-propeller, is being built by some mechanics of Hillsboro, Kansas. A 410 H.P. King-Bugatti aeroplane engine is to be installed in the rear of a racer Cadillac chassis.

Since the recent publicity given to the experiments with gliders, now claiming the attention of aeronautical enthusiasts in Germany, several American model fliers are becoming interested in this branch of the sport. Some of our Americans who are familiar with the German language are making a detailed investigation of the German types with a view to building exact reproductions with, it is hoped, improvements which will make the "motorless" plane more popular in the United States.

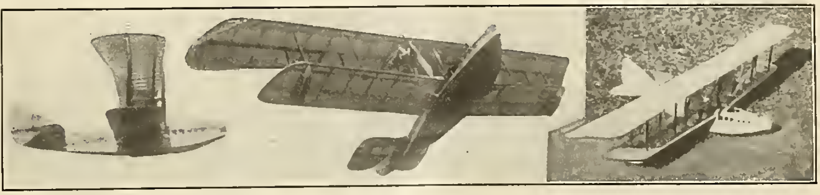
Scale Models Built by Readers of Aerial Age

An accurate exhibition model of a flying boat has been built by Mr. L. W. Lawrence, of Fairhope, Alabama. This model, which bears a striking resemblance to a modified F5-L flying boat, was built from materials obtained in Mr. Lawrence's own shop.

These are the dimensions:

Span, upper wing	53 inches
Span, lower wing	42 inches
Wing chord	5⅛ inches
Area (with ailerons) upper	260 sq. in.
Area, lower wing	194 sq. in.
Total wing area	454 sq. in.
Stabilizer area	30 sq. in.
Elevator area	19 sq. in.
Rudder area	12 sq. in.
Fin area	14½ sq. in.
Length of hull	22 inches
Width of hull	6½ inches
Depth of hull	3 inches
Gap between wings	5 inches
Draught (light)	¾ inch
Draught (loaded)	⅞ inch
Weight of boat complete	17½ ounces

The covering is with bamboo paper treated with three coats of dope and finished with two coats of Valspar. An 8½-inch diameter propeller is provided for each of the two dummy 12 cylinder Liberty motors.



An F5-L type scale model of 53-inch span made by L. W. Lawrence

A-E-R-O-N-I-T-I-S

Health Hints

Dear Doctor—How can I acquire more pep?—Lazy.

Answer—Wave a red shirt in front of a bull.

Dear Doctor—Would you advise me going to Colorado for my health?—Joe.

Answer—If you left it there, yes, by all means.

Dear Doctor—What's good for sore eyes?—Bill.

Answer—Stand on the corner of Fifth and Broadway for one hour on a windy day.

Dear Doctor Is a walk on an empty stomach injurious?—Bob.

Answer—It all depends on whose stomach you walk on.

Regardless of how much work a paperhanger has, it always drives him to the wall.

She: "What kind of gardens give you the most satisfaction?"

Sailor: "Beer gardens, my good lady, beer gardens."

Other Times, Other Manners

O youth, beware the fond gazelle,
Else will you presently regret it,
In other days they pined and died,
But now they sue for cash—and get it!
—*American Legion Weekly.*

"Lives of great men oft remind us
We should choose our wives with care,
And departing, leave behind us,
Half our natural growth of hair."
—*Fasces.*

Never Snooked a Snook

"I want to start annulment proceedings against my wife," growled a big, red-faced man as he flung his bulk into a chair in a lawyer's office.

"On what grounds?"

"On the grounds of misrepresentation!" bawled the irritated client. "She insists on calling me Snookums."

—*American Legion Weekly.*

He Was a Deckhand

A sailor who had landed after a long voyage and been paid off, called a taxi, threw his luggage inside and jumped up on top himself.

"Beg pardon," said the astonished driver, "but you should get inside and put your boxes on top."

"Steer the craft, me hearty," chirped the gob. "Passengers always go on deck and the luggage in the hold."

A Blooming Chicken

Little Mary was visiting her grandmother in the country. Walking in the garden, she chanced to see a peacock, a bird she had never seen before. After gazing in silent admiration, she ran quickly into the house and cried out: "Oh, granny, come and see! One of your chickens is in bloom."

—*The Christian Register.*

"Help, help!" screamed the terrified young man who had just fallen off the wharf. "I can't swim!"

"Wot of it?" asked the stevedore mildly, taking his pipe out of his mouth and glancing carelessly over the edge of the wharf. "I can't neither, but I ain't yellin' my head off about it."—*Pathfinder.*

Mose: Dis yar flying business is ah mighty ol' venture.

Rastus: How you make that out, Mose?

Mose: Because I heah that pastor say in church las' Sunday night dat Esau sold his heirship to Jacob.

Home Broo

Pursue a wild bullfrog thirteen miles, carefully gathering the hops. Then add:

10 gallons of pickle brine,
2 quarts of shellac,
1 bar home-made soap,
1 pint sweet spirits of nitre.

Boil mixture three weeks then strain through an I. W. W. sock to prevent mixture from working. Bottle and add one mule to each pint to give it the proper kick.—

—*E. McD.*

At a dinner one day in Pomona,
They served only steaming bologna.
"It looks queer,"
Said a maid, "I do fear
I shall have to remove its kimona."

It is not good for a man to be alone; that's why woman refuses to do so.

Rose: Why is it that professors claim touch to be the most delicate of all the senses?

Mary: Because when you sit on a pin you can't see it; you can't hear it; you can't taste it—but it is there just the same.

Take Ear, Oh Men!

Jane: "What do you think of a man who throws a girl a kiss?"

Babe: "I think he's the laziest man in the world."

Bill: "S'funny, ain't it?"

Buster: "Shoot."

Bill: "Bills are rectangular, yet they come rolling in."

There's a Reason

By Edna McDonald.

Now that women smoke, vote and wear "knickers," it's a wonder they don't want to be more masculine and raise a beard. Here is one reason why they can't. If anyone can think of a better reason, a pickled herring will be the prize.

How wisely Nature, ordering all below,
Forbade a beard on woman's chin to grow;
For how could she be shaved with skill—
Whose tongue will never let her chin be still?

The Newlyweds

Hon and Dearie were married in June and were on their honeymoon.

After many delays, they were all set to go out one evening when Dearie said:

"Just a moment 'til I comb my hair, darling."

"No, Dearie, let Honey comb it!"

The hotel authorities put a two cent stamp on the blotter containing the poor boy's remains and Dearie is still raving and frothing at the mouth in a padded cell.

MORAL: True love never runs smooth after the "hitch" occurs.

He came to her at sunset like a feeble moth to the flaming candle. He hovered about her as her magic ever drew him closer. His heart rose in his bosom as he drew nearer—like nothing but the dusty-winged moth.

Closer, closer—until the wings almost touched the searing flame—the flame that meant death, destruction. But her heart melted and she spared him.

She turned out the light!

Binks—"Jones has a mania for playing the clarinet when he's stewed."

Jinks—"Huh, trying to imitate the 'Pie-eyed Piper' eh?"

"Jack leads a pretty wild life, doesn't he?"

"Yeah, his old man owns a sugar plantation and he just naturally has to raise cane."

He—"Would you care to dance this dance?"

She—"Yes, would you mind asking someone for me?"

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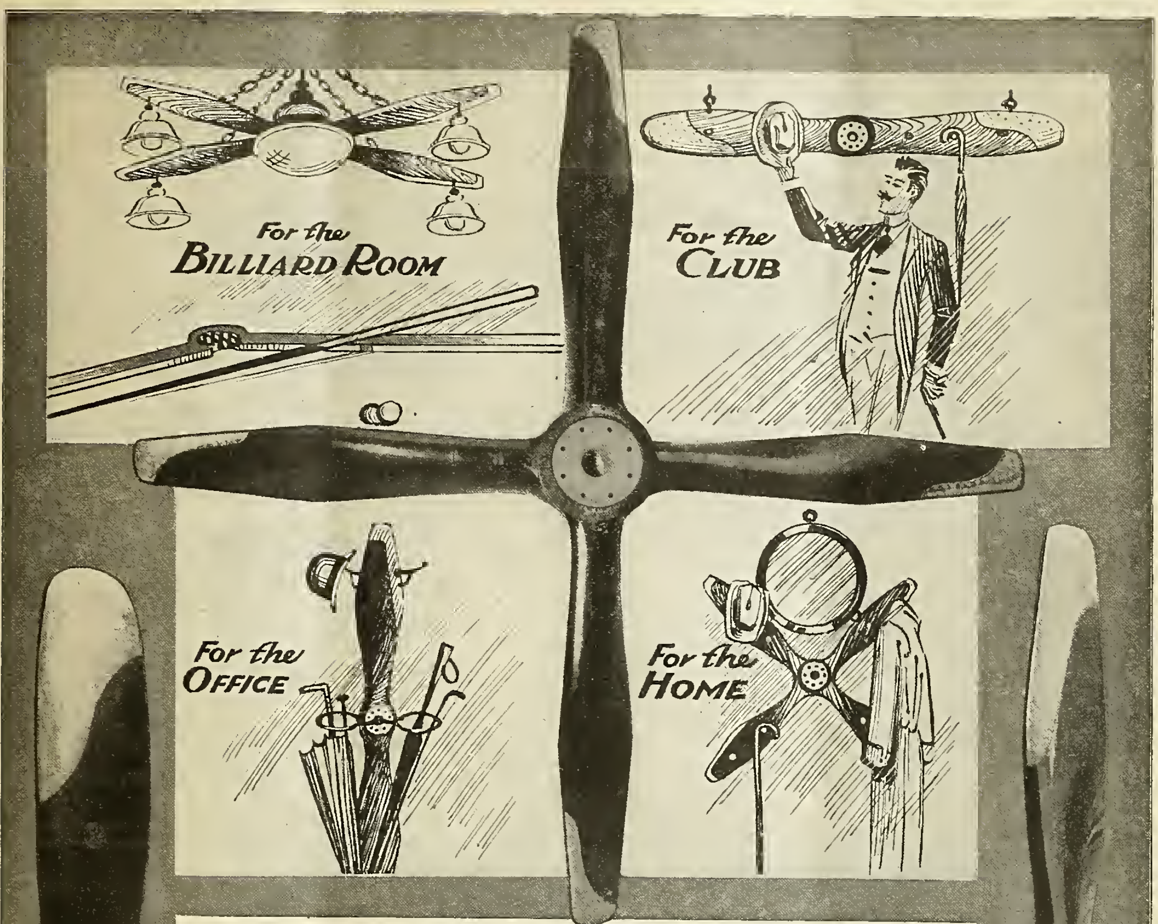

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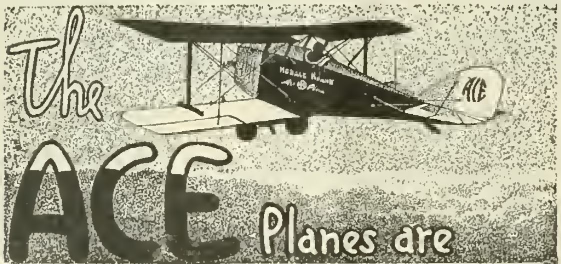

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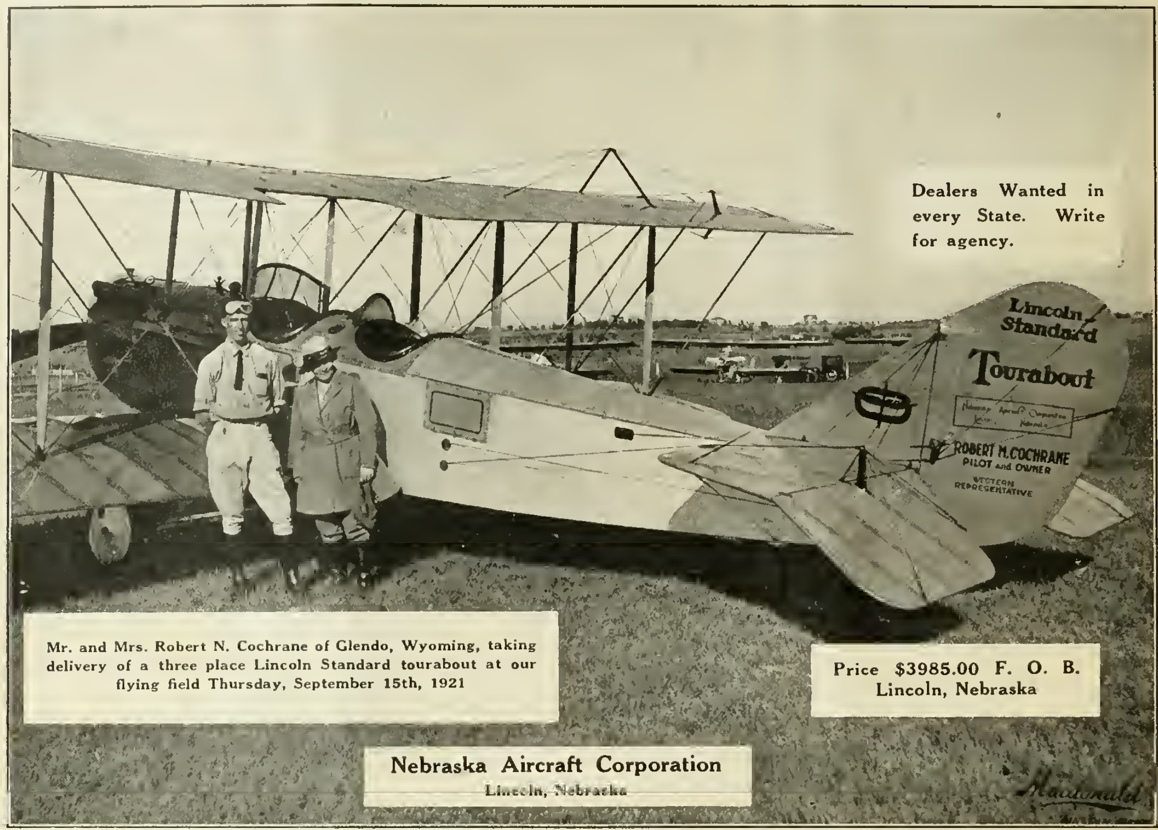

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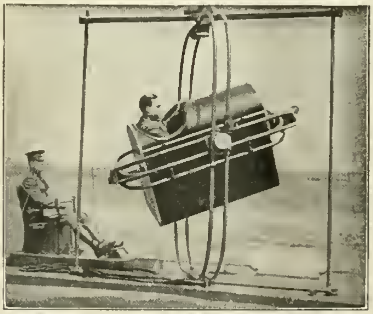

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Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

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Airscape of St. Albans Golf Club Photographed for the Fairchild Aerial Camera Corp., by W. L. Hamilton

The Truth About Our Aeroplane Record

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AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. Theoretical and Experimental Aerodynamics. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Vol. II. Applied Aerodynamics. Contents.—Estimation of Performance. Stress Analysis. Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

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The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

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October 24, 1921

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TABLE OF CONTENTS

Discounting Naval Aviation 147
A Serious Naval Problem......... 147
The News of the Week........... 148
The Aircraft Trade Review....... 149
N. A. C. A. Recording Air Speed Meter 151
Information for Pilots Giving the Practical Characteristics of the Land Along Various Air Routes. 153
The Truth About Our Aeroplane Record 155
Naval and Military Aeronautics... 159
Foreign News 160
Elementary Aeronautics and Model Notes 161
Aeronitis 162

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Discounting Naval Aviation

IT cannot be denied that the Navy Department has resisted, or only half-heartedly advocated, the development of aviation ever since Admiral Fiske first urged its importance in 1916. During the preceding Administration the Secretary of the Navy and the Chief of Operations cut appropriations, discouraged progress, and sent us into the world war with no aviation material and with a devoted little band of only forty-five trained fliers.

Following the war, until very recently, the record of neglect and obstinacy has continued. The Daniels regime, in its staggering demand for twenty additional $40,000,000 capital ships, submitted the naval bill with only a petty little $6,000,000 for aviation. The present naval administration was finally goaded into a tardy advocacy of two aeroplane carriers, but its continued insistence upon the 1916 programme caused Congress to cut from the bill the two weapons most needed by the navy —submarines and air forces.

General Mitchell declared that he could sink battleships with bombs. The late Secretary of the Navy pooh-poohed the General, sarcastically called him "Admiral" Mitchell, endeavored to throttle him, and capped the climax by declaring that he would gladly stand on the bridge of a ship and let Mitchell bomb it!

Well, where would the silly Josephus be to-day? "Admiral" Mitchell proved the soundness of his every claim. The Joint Board was forced to admit that bombs can sink any ship that floats and any ship that can be designed.

Moreover, the bombing of the German ships would have been a farce had it not been for General Mitchell. It appears that the Navy Department, the General Board and the "Prinicpal Dignitaries" in the bureaus were anxious that the ship should not be sunk by bombs. The "rules" of the game appeared to have been drawn to protect the targets. The little naval air contingent had slight opportunity to show what it could do. It was permitted to use only lightweight bombs. The navy planes with 1,000 and 2,000 pound bombs were turned back in compliance with the "rules." And when Mitchell sank the Ostfriesland the cry was raised that he had violated the rules—"disobeyed orders!"

Grant that he did. Nelson disobeyed orders at Copenhagen and won the battle. If Mitchell disobeyed orders he at least taught us something of vital importance to the country. The "rules," the "orders" would have taught us—nothing. Shall we court-martial the General who did something and taught us something? Or shall we court-martial the "orders" which taught us nothing, and which might have prevented us from learning anything?

And the Alabama experiments furnish more evidence of lackadaisical indifference at the War and Navy Departments. These tests would never have taken place but for Mitchell's insistence. And the Navy Department sends a board to witness them composed of a naval constructor and a few young officers of the navy—all excellent officers to be sure. But where were all the admirals and captains of the navy? Could not the Chief of the Bureau of Navigation or the Chief of Operations find one line officer of high rank to witness and report upon tests second only in importance to those of the Ostfriesland—tests that had never been made before by any army or navy as far as we know?—*Editorial in N. Y. Herald*

A Serious Naval Problem

UNLESS higher officials of the Navy Department take steps to prevent it, more than 200 naval aviation reserve officers,, who served during the war, and the service of most of whom is declared vitally needed for the development and upbuilding of the naval flying corps, will be forced out of the navy by the examinations recently held to enable them to enter the line of the navy.

Out of about 400 temporary and reserve aviation officers who took the examination, only about 130 passed, approximately 32 per cent. This means that, unless the Navy Department adopts a more lenient attitude, about 270 temporary and reserve officers will fail to enter the line of the navy, and of this number approximately 200 naval reserve aviation officers will be forced out of the service.

Those who are familiar with the facts in the case assert that the loss of these officers will not only work unfairly and unjustly to them, but will seriously cripple the naval aviation service. Their failure to pass the examination to admit them into the line was not due to lack of practical knowledge or experience in naval aviation, but because they were not able to meet that part of the examination based on technical subjects dealing with naval, rather than aeronautical matters, with which they were unfamiliar and unable to qualify because of a peculiar combination of circumstances. While they were allowed so many months in which to "bone up" on the subjects with which they were unfamiliar, the fleet manoeuvres, various kinds of official flying duty and the bombing tests interfered with the opportunities to study.

Secretary Denby is understood to be looking into the matter, and it is the hope of those who are interested in the future of naval aviation that he will find a way for retaining most of the reservist aviation officers. If the matter stands where it is it will be impossible, it is asserted, for the navy properly to operate the aviation bases it intends to retain under its present plans of economy.

THE NEWS OF THE WEEK

Successful Meet at Curtiss Field

To demonstrate the practical value of the aeroplane as a commercial vehicle of travel and to show the public the results of a year's progress in aeronautical development the Aero Club of America held a flying meet at Curtiss Field, near Mineola, L. I., October 16. More than 5,000 persons attended. After the various contests, in which a dozen planes of both American and foreign manufacture participated, short "hops" were given to as many spectators as could be taken up before it grew too dark. During the afternoon about fifty planes landed and took off from Curtiss Field.

Apart from the newest types of aeroplanes, which, like the automobile, embraced the slow and the fast, the open and the enclosed models, popular interest centred in an efficiency contest for a trophy offered by the Wright Aeronautical Company, makers of the Hispana-Suiza engine. The trophy was put up for the best demonstration of manoeuverability. Five planes were entered in this contest, which started October 14 and ended October 16.

The Loening flying yacht, holder of the world's altitude record with passengers of craft of this type, which on October 14 made six round trips between Port Washington and New London, Conn., made four round trips from the same starting point to Southampton, L. I., on October 16. The time on the New London route was 5 hours and 33 minutes for the six trips. The total cost of carrying twenty-four passengers was $65, which included oil, gas, depreciation and insurance. The railroad fare would amount to $135.40. This was believed to be a new seaplane fuel economy record. Clifford Webster was pilot. Grover Loening, builder of the flying yacht, was one of the passengers. The average time for the trip to Southampton was 42 minutes. Four passengers were carried. All the trips were made on scheduled time.

J. L. Larsen chose a route from Mineola to Miller's Field, New Dorp, S. I., for his all-metal limousine plane. Piloted by John F. Petre, it made six round trips at scheduled three-quarter hour intervals, carrying seven passengers. The average time for negotiating the thirty-two miles was twenty-three minutes. The plane flew at a height of 2,000 feet.

The Fokker Half Moon made its trip on Saturday, flying to Providence, R. I., from Mineola, with six passengers and pilot. The figures showed that it flew the 290-mile trip distance in three hours and fifty-nine minutes at a total cost of $53.90, as against a railroad cost of $105.50. Bert Acosta was pilot.

A Farman sport plane sought to win the trophy on points for general manoeuverability. Lawrence Sperry's plane entered on a similar basis. In the take-off it left the ground in twenty-nine seconds. It climbed 1,500 feet in nine minutes with five passengers aboard.

By way of contrasting the present type of plane with an earlier model, Bert Acosta flew in a Curtiss biplane built in 1911. The pilot in this machine, which looked none too secure, sat in the fore part of the machine and when the plane was in the air he seemed astride a bicycle. The 1911 model averaged eighty miles an hour. The largest and smallest planes in this country, the Remington Burnelli with a wing span of 77 feet and accommodations for thirty-four passengers, and the Mummert Cootie with a 15-foot wing spread, went up together. The Burnelli plane took up fifteen persons at a time. Bert Acosta piloted the Mummert plane, flying the machine in his stocking feet, because, as he explained, he did not care to overweight it.

One of the events which found favor with the crowd was a balloon chase. Small toy balloons filled with hydrogen gas were released from the ground. Aviators sought to shoot them down by knocking their propellers against them. Acosta in the 1911 Curtiss hit three, Richard Depew's Curtiss put two others out of commission, while several other pilots exploded one apiece.

A parachute jumping contest was another thriller. A mark was made on the ground which the jumpers were to attempt to touch. Peter Devlin won first prize when leaping from a height of 1,500 feet; he landed forty-three yards from the mark. F. U. Meeker came second, hitting the ground 150 yards away. He jumped from a height of 1,500 feet.

Benedict Crowell, former Assistant Secretary of War, who recently was elected President of the Aero Club of America, issued the following statement at the conclusion of the meet:

"The flying meet at Curtiss Field today, and those which are shortly to be held in Kansas City and Omaha, mark the real beginning of American air power. They are especially significant in the light of the forthcoming conference in Washington which hopes to relieve a tax-weary world burdened by excessive and unproductive armaments.

"Without minimizing the value of the older arms on land and sea, which we must always have, the flying which is going on throughout the country today offers the greatest hope to the nation of a successful outcome at this conference. We must have protection of the most efficient and economical sort. This is what the air power provides.

"American aviation offers a real contribution to our transportation problem and is ready to assist in the present crisis. As it grows in economic efficiency, it will increase also as that defensive factor which is the cheapest, speediest and the most certain in the time of need."

H. H. Hartney and Augustus Post of the Aero Club of America were in charge of the meet. They said the winner of the efficiency trophy would not be known until the records were checked.

Aerial Service Planned for Duck Hunters

C. F. Redden, president of Aeromarine Airways, Inc., announced that flying boats of his line will make special flights to Great South Bay and to Chesapeake Bay for sportsmen during the duck hunting season. The flying boats will be equipped with everything necessary for the comfort of the sportsmen.

"This service," he said, "is to be inaugurated as an auxiliary in the development of commercial air transportation. We have had a large number of inquiries from wealthy sportsmen who are anxious to obtain a speedier means of transportation to and from the almost inaccessible reaches around Pimlico and Albemarle sounds and Chesapeake Bay. With flying boats it will be possible for them to traverse in minutes distances that it now takes them hours to cover."

The local wild duck season opened October 16, and the first to take advantage of the novel service offered by the Aeromarine Airways, Inc., was Lieutenant Commander J. A. Davis, U. S. N., with a party of three friends.

Quick Washington-New York Flight

WASHINGTON.—Flying at an average speed of 170 miles an hour, Lieutenant Howard K. Ramey, piloting a De Haviland army aeroplane in which Lieutenant Leroy Wolfe was a passenger, made the trip from Washington to New York on October 10 in 79 minutes, setting a new record. It was announced at Bolling Field.

The previous best time for the trip was 86 minutes. The flight was made at an average height of 3,800 feet.

Denby Urges Aircraft Carriers

The Navy Department plans to ask Congress immediately for additional appropriations to build aircraft carriers for the Navy and will go ahead with its building program regardless of the arms conference.

Official announcement to this effect was made October 12 by Secretary Denby to the House Naval Affairs Committee. The department sees that decisions by the conference cannot be anticipated and realizes that the Navy is lacking in certain elements of a well rounded fleet.

The Secretary's statement is an answer to those who expect the conference to "disarm," and shows that the best that can be expected of it for armament is a limitation which will lessen economic burdens and eliminate the danger of competitive building among nations.

The Navy has not changed its belief that the capital ship remains the basic unit of the fleet. Naval officers believe there has been much misconception on the views of the Navy General Board, owing to the debate precipitated over the relative merits of the capital ship and aircraft.

Naval officials guiding the construction program think the bombing tests have demonstrated the increased possibilities of aircraft. No one has been quicker to recognize this than the naval group which retains its faith in the capital ship. It is their belief that all future naval operations will be carried on with a large complement of air craft for bombing and for long distance gunfire.

The Navy is daily developing new possibilities in long range guns and sees the time when navies will fire at each other over the horizon, making aeroplanes necessary for range finding.

Aeroplane construction has not reached the point where the heavier-than-air craft can operate far from their base and carriers are essential to transport them with the fleet. Experiments are being made also to have each warship carry its own complement of aircraft. With the exception of the converted aircraft carrier Langley, the American Navy is not equipped with carriers.

The determination to go ahead with construction has in mind in part the other elemental weakness of the Navy shortage of light fast cruisers. Any limitation of armament at this time would find the American Navy lacking in this important requisite.

Amundsen Plans Aerial Journey to North Pole

Seattle.—Determined to reach the North Pole regardless of risk, Captain Ronald Amundsen, discoverer of the South Pole and conqueror of the Northwest Passage, will resort to the aeroplane, if necessary, writing a new chapter in Polar exploration, it was disclosed when he began negotiations for the purchase of two aeroplanes. He will have the aeroplanes aboard his Arctic exploration ship Maud when he sails out of Seattle harbor next May on his way to the great wastes of the Far North.

News of Captain Amundsen's plan to fly to the North Pole was confirmed by H. H. Hammer, president of the Universal Shipping and Trading Company, who is acting as the explorer's general agent here. Captain Amundsen is a pilot, Mr. Hammer said.

Captain Amundsen has engaged two Norwegian aviators for the next effort to reach the North Pole. One served in the Norwegian army and the other in the navy.

They are to arrive here the first of the new year. The original plan of the Amundsen expedition, which is financed by the Norwegian government, was to drift with the Arctic ice pack to the North Pole. Last fall the Maud damaged her propeller in the ice off Siberia, delaying the expedition one year. She was towed into Behring Sea by the coast guard cutter Bear and then sailed all the way to Seattle under her own canvas. She is now moored in Lake Union here. In the meantime Captain Amundsen is busy preparing for the departure of the expedition next May.

Wants Air Warfare Taken up at Parley

Rome.—Senator Morandi, the boyhood tutor of King Victor Emmanuel, interpellated the Government in the Senate on the course to be followed by the Italian delegation to the Washington conference on limitation of armaments and Far Eastern questions.

He said that since incredible progress had been made in aerial navigation, that question should be put forward at the conference. Signor Morandi suggested discussion on the substitution of aerial forces for capital warships, which he declared, were "carrying the Governments to financial ruin." He said that Japan was extremely vulnerable to attacks from the air because of its wooden houses.

House-Hunting by 'Plane

Paris.—A wealthy American intending to spend the winter in Paris adopted a novel method of finding an apartment during the housing crisis. Hiring an aeroplane, he had the pilot drop 100,000 cards announcing that he was seeking an apartment with nine rooms and two baths, regardless of price. The aviator sprayed the cards over the Avenue Bois de Boulogne, the Etoile, the Champs Elysees and the Rue de Rivoli.

The American is reported to have received 200 replies.

Helium Gas for Airships to Be Tested by the Navy

Washington.—Plans are in progress to make practical use of helium gas in navy airships in the near future. An immediate start is to be made in experimenting with the gas at the naval air station, Hampton Roads, Va., where a non-rigid airship of the C class will be inflated. This experimentation is being conducted in connection with tests in regard to buoyancy, valve control, permeability of airship fabric and methods of handling helium in connection with all types of lighter-than-air craft.

This will be the first airship in the world to be so inflated, and it is expected that important data will be obtained which it is hoped will be of considerable value in future employment of the gas.

This will be in accordance with the provisions laid down by the aeronautical board of the army and navy for the experimentation and development of lighter-than-air craft.

Alula Wing Test

London.—A demonstration was given October 12 at the Northholt aerodrome of an aeroplane fitted with wings of a new design that in the inventor's opinion is likely to revolutionize air flight.

The "Alulu" wing is the invention of a Dutchman, Mr. Holle, who hopes soon to attain a speed of between 200 and 300 miles per hour with it. The wing was described in detail some months ago in AERIAL AGE.

When the pilot came down after a long series of manoeuvres he said he had been traveling at 184 miles an hour, and that his rate of climbing was as high as 2,500 feet a minute. The angle of some of his ascents was sixty degrees.

Aviator's Mother Honored

London.—Mrs. McCudden, mother of the late Major Byford McCudden, V. C., of the Royal Air Force, has been chosen to take to Arlington a national wreath for the grave of the Unknown American Warrior. This selection was made under the auspices of the Pilgrim Fathers' Association from a list of eight mothers bereaved in the war. Over 600 of these mothers had expressed the wish to undertake the duty and the final choice was not easy.

Mrs. McCudden's husband, who was accidentally killed last year, had thirty years' army service. She had three sons killed in the war and also lost her son-in-law and two nephews on active service.

The Kokomo Aero Meet

Forty-three aeroplanes of various types and sizes, and representing practically every state in the central west, took part in the national aviation meet held in Kokomo, Ind., September 22 to 25. When the last contestant brought the wheels of his ship to the ground he ended an aircraft "get-together" that was, in the opinion of every participant, the most successful ever held in this section of the country.

Originally scheduled for three days—Thursday, Friday and Saturday—the interest on the part of the visitors prompted those in charge to continue the meet over Sunday, since, by so doing, the residents of that vicinity who were unable to get to the field during the week would have an opportunity to see the commercial and army fliers in action and examine the various types of planes on exhibition. When approached on the subject of staying over for another day, all pilots immediately consented, as they were anxious to prove to the public the utility of the aeroplane.

Thursday—the first day of the meet—was a busy one at the flying field. Visiting pilots started to arrive early, and by noon there were 18 ships neatly parked "on the line" awaiting the beginning of the various contests to be held in the afternoon. These events consisted of a speed race, formation flying over the city, exhibition and acrobatic flying, altitude tests, "dead stick" landings and two parachute exhibitions. One of these was from an altitude of 3,000 feet by "Laddie," the famous parachute dog, and the other by Master Sergeant Ralph W. Bottriell of Dayton, O. The sergeant was flown to Kokomo for the occasion in a DeHaviland machine, piloted by Lieutenant Van Zandt of McCook Field, the trip of 125 miles being made in an hour and twenty minutes. Before the end of the afternoon hundreds of motor cars parked around the field and on nearby reads, many of which carried license tags of adjoining states. The thousands of spectators that lined the airdrome were kept busier watching the various air events than a boy witnessing a three-ring circus for the first time.

The night program ended with an exhibition by Major Wilbur M. Fagley and Ross Jacobi, who took off in their electrically-lighted aeroplanes and thrilled the spectators by their daring and spectacular flights. Flying for a minute or so with their planes outlined by miniature electric lights, they took great delight in switching them off for a brief period only to flash them on again to reveal their presence a mile or so away from where they were last seen.

Perfect landings were made with the aid of automobile headlights. Among the day's arrivals were E. M. Laird, designer and builder of the Laird Swallow, who, with his pilot, Buck Weaver, flew in from Wichita, Kansas, in 6 hours and 35 minutes; R. W. ("Shorty") Schroeder; Floyd Logan, aeroplane dealer from Cleveland, and George Eikenberry of Bluffton, who flew in with one passenger.

Friday's program was similar to that of the first day, but more interesting because of more ships being in the various events. Among the new arrivals were Lieut. Nelson and Capt. Fleet, who flew SE-5's from McCook field; a Farnum from Dayton, O., flown by Al Johnson and carrying John Rae as passenger, and a Morane parasol monoplane with Pilot Lieut. Haskell and J. Burke, an army photographer.

In the evening the visiting pilots, army officers and prominent Kokomo business men were guests at a banquet given by the Curtiss-Indiana company at the Country club. Pilots from different states were present, as well as newspaper representatives.

Saturday afternoon brought thousands of spectators to the field, and the day's activities were strengthened by the arrival of new machines. These included Capt. R. L. Meredith, flying a Fokker with a 180-horsepower Mercedes engine; Naval Lieutenant J. D. Price and Lieut. Frank B. Tindall in a DH-4, powered with a 300-horsepower Hispano-Suiza engine, and Lieutenant Niedermeyer, who arrived flying upside down in his Fokker monoplane.

No one could have attended the four-day meet without taking back with him a definite impression that the aeroplane was slowly but surely taking its place as a commercial vehicle that will soon be in everyday use between large cities throughout the entire country. It is just such air meets as this one that do much toward convincing the skeptic that aviation is not a "game" but a business.

The idea of the Kokomo meet was conceived by Major Wilbur M. Fagley, secretary of the Curtiss-Indiana company, who was assisted by the chamber of commerce of that city in the carrying out of his plans. Much credit is due to the Boy Scouts who patrolled the landing field constantly and kept it clear for the pilots at all times.

Number of machines participating	43
Number of landings	215
Miles flown during meet (estimated)	2,000
Forced landings	None
Accidents	None

The AIRCRAFT TRADE REVIEW

Curtiss Eastern Takes Over Atlantic City Station

The Curtiss Eastern Airplane Corp., distributors for Curtiss aeroplanes and motors for the southern part of New Jersey and the States of Pennsylvania, Maryland and Delaware, have taken over the Curtiss Flying Station at the Inlet in Atlantic City, N. J. This station will be run under the direct management of the Curtiss Eastern Airplane Corp., and will be kept open all year round for passenger carrying, aerial photography and sports purposes. They will also keep a large stock of spare parts on hand and will be able to handle any work such as repairs and overhauling that will be necessary.

Aeromarine Airways

Commercial aviation in this country is an actuality. Aero-marines have flown thousands of miles during the past two years; have carried thousands of passengers without accident and the Aeromarine Airways at the present time are operating the largest type of aeroplane or flying boat in existence.

The flying boats operated in this service are more luxuriously equipped; more practically fitted out and in no way inferior to the best air lines in Europe. The attached reprint of an editorial in the Evening Mail indicates that American aviation is being given credit which is justly due it.

The Aeromarine Airways will continue this winter a service between Key West and Havana with five ten-passenger flying boats of which the Santa Maria now in New Orleans on its way to Vera Cruz is an example. This one particular route reduces the time of travel between Key West and Havana from seven hours (by boat) to seventy-five (75) minutes; a saving of time and inconvenience which last winter was greatly appreciated by the traveling public as indicated by the number of passengers carried without accident.

Coffin Addresses Detroit S. A. E.

Detroit.—The Detroit section of the S. A. E. was urged by Howard E. Coffin at the first fall meeting to take early steps toward recommending to Congress the necessity for immediate action on legislation establishing control of the air. Enlistment of private capital in development of commercial air service, he said, cannot be successfully negotiated until such legislation is enacted.

Coffin commended the bill introduced by Senator Wadsworth of New York as satisfactory from an emergency standpoint, while awaiting the formal report of the American Bar Association on the status of air control. To-day, he said, "the only law effective in this country affecting aviation, is the well known law established by Mr. Newton several hundred years ago."

He criticized the laxity which to-day permits anyone to fly any sort of plane, comparing this with the care exercised in the supervision of elevators in buildings. His talk preceded a showing of the official Army and Navy motion pictures portraying the sinking of the German warships by Army and Navy air craft.

Dr. H. C. Dickinson of the Bureau of Standards, Washington, spoke on the activities of the department in automotive research and asked for the co-operation of the private research departments of the factories in reaching conclusions. He said much of the study is of general character and should be accessible for the benefit of the entire industry.

Canadian Registration

The Underwriters'. Laboratories advise that the air board of Canada has recognized the Aircraft Register of the Underwriters' Laboratories and that until further notice it will not be necessary for aircraft registered by Underwriters' Laboratories and seeking permission to fly into Canada to have the letter "C" as the first letter in its registration marking.

Applications for aircraft registration and pilot's register can be made to the Underwriters' Laboratories, 207 East Ohio Street, Chicago, Ill.

Seaplane Landing Stations in New York

The commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that landing for seaplanes can be found at the following places:

Gardiners Bay, Long Island, in depth of about 6 fathoms, sand and mud bottom, with good beaching facilities; rise and fall of tide 2.5 feet. There are no obstructions. *Landmark.*—Plum Island Lighthouse. *Supplies* of all kinds can be had at Three Mile Harbor.

Fort Pond Bay, Long Island, in depths of 7 to 8 fathoms, soft mud bottom, with good beaching facilities; rise and fall of tide 3 feet. The landing is exposed to north and northwest winds. *Supplies.*—Gasoline, oil, and fresh water can be obtained at Montauk.

Greenport, Long Island, in depths 2 to 6 fathoms, hard bottom, with good beaching facilities; rise and fall of tide 2.4 feet. *Supplies* and repair shops can be had at Greenport. *Landmarks.*—Pier and two large gasoline tanks; best beach to left of tanks and pier. Greenport is an important town and the terminus of a branch of the Long Island Railroad. There are well-equipped shipyards and machine shops. Depth at the wharves ranges from 7 to 19 feet.

Oyster Bay, Long Island, in depths of 7 to 45 feet, mud bottom, with good beaching facilities; rise and fall of tide 7.3 feet. *Supplies* and repair shops at Oyster Bay. *Landmark.* — Village and Eaton Neck Lighthouse. Oyster Bay is a village with railroad communication on the southern shore of Oyster Bay Harbor. All kinds of stores can be had. Rockaway to Oyster Bay 27 miles 41°.

Albany.—Seaplanes can land at Albany in depth of 11 feet at low water, mud bottom; rise and fall of tide 2.9 feet. Landings may be made above and below Albany; beaching facilities only fair. *Supplies* of all kinds are available. Ships should take off south of Albany; taxi to plenty of water. Albany is on the west bank of the river 125 miles from the Battery, and 24 miles from Hudson, a small village below Albany.

New Rochelle.—Seaplanes can land at New Rochelle in depth of 10 feet, mud and gravel, with beaching facilities on the bathing beach. *Obstructions.*—Numerous small craft anchored. *Landmarks.*—Two flagpoles, two chimneys, and white church steeple; lighthouse. *Supplies* of all kinds can be procured. This is a good anchorage in all kinds of weather.

East Quogue, Long Island.—Seaplanes can land at East Quogue in shallow water with poor beaching facilities (cannot approach within 100 feet of beach); bottom not good. *Obstructions.*—A few pier stakes and small sailing vessels. *Landmarks.*—Town of East Quogue, East Quogue Hotel, Coast Guard stations 73 and 74, Shinnecock Lighthouse. *Supplies* and repairs ½ mile.

Clifton, Rosebank, Stapleton, Tompkinsville, St. George.—Seaplanes can land off the above villages on Staten Island in depths of 22 to 75 feet, soft mud bottom, with good beaching facilities; rise and fall of tide 4.5 feet. *Obstructions.*—Steamers and sailing vessels will be at anchor but there will be lots of room for landing and take-off. *Landmarks.* — Stapleton Pier; Fort Wadsworth Lighthouse, red brick, 2,000 yards below Rosebank. *Supplies* of all kinds may be obtained. Coming up the Narrows on the left hand is a red brick lighthouse (Fort Wadsworth); 2,000 yards farther up is town of Rosebank; 1,100 yards, Clifton; 1,200 yards, Stapleton; 1,200 yards, Tompkinsville; 800 yards, St. George.

Providence Seaplane Landing

A landing for seaplanes can be found at Providence, R. I., in depths of 10 and 30 feet, mud bottom, with good beaching facilities; rise and fall of tide 4.6 feet.

Facilities and supplies of all kinds are available. From Oyster Bay to Providence is about 126 miles; course, Oyster Bay to Brenton Reef Light Vessel 72°; Brenton Reef Light Vessel to Providence 356°.

New Jersey Landings for Seaplanes

The commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that seaplanes can land at the following places:

Keyport.—Seaplanes can find a landing at Keyport, on Raritan Bay, in from 3 to 4 feet at mean low water, gravel and mud bottom; rise and fall of tide 5 feet. There is no beach. *Landmarks.*—Aeromarine factory. *Supplies* at Aeromarine factory. Storm warnings are displayed at Keyport. In taking-off taxi beyond bar.

Pleasure Bay, Long Branch.—At Pleasure Bay good landing for small planes may be found, depth of water 10 feet in channel; rise and fall of tide 1½ feet; bottom mud. There are no beaching facilities. *Landmarks.*—Long Branch Steamship Co.'s building with red roof, Coast Guard Station 101. *Supplies* can be obtained. There is room for take-off of Small planes only.

N.A.C.A. RECORDING AIR SPEED METER

By F. H. NORTON
Langley Memorial Aeronautical Laboratory

Summary

A NEW type of recording air speed meter is described which was designed by the technical staff of the National Advisory Committee for Aeronautics. The instrument consists essentially of a tight metal diaphragm of high natural period which is acted upon by the pressure difference of a pilot-static head. The resulting deflection of this diaphragm is recorded optically on a moving film. A number of records taken by the instrument are shown.

Introduction

Air speed in flight has been recorded almost exclusively in France and in this country by the Toussaint-Lepère air speed meter which consists of a recording pen operated by a spring loaded bellows. For very accurate work this instrument has a considerable amount of friction and its natural frequency is so low that it can not be used to record rapid changes in air speed, such as bumps in flight or pulsations in the wind tunnel. The British have constructed a successful recording air speed meter in combination with their Mark II accelerometer, which is of a higher frequency and with less friction than the Toussaint-Lepère instrument.

The N.A.C.A. air speed meter (Fig. 3) was designed with the idea of producing an instrument for recording the absolute air speed in flight with great accuracy and at the same time to have such a high natural frequency that it could be used to study the structure of rapidly changing air flow. As this instrument is of general usefulness in recording pressure difference it was thought that a complete description would be of interest.

Diaphragm Capsule

The pressure difference to be measured is transmitted to either side of a steel diaphragm which is rigidly clamped at the edges between the halves of a circular capsule. As an unstretched diaphragm—due to a trace of concavity which cannot be removed—has two points of equilibrium at zero pressure, it was found necessary to warm the diaphragm before clamping in order that it might be normally under a slight tension. It is also essential that the material of the capsule and the diaphragm have the same coefficient of expansion, otherwise the sensitivity will change with the temperature. This capsule and diaphragm is shown in Figs. 1 and 2.

A hardened steel screw passes through the center of the diaphragm and rests against the polished back of the mirror staff. This staff is mounted in a highly polished conical steel socket and is held against the diaphragm screw by a light hair spring. A plane silvered mirror 4 mm. square and .2 mm. in thickness is cemented to the staff. The deflections of the diaphragm are thus converted into a rotary motion of the mirror with very slight friction. The natural frequency of the diaphragm and mirror is about the same as that of a telephone diaphragm—2,000 vibrations per second. This frequency could be made even higher than this if it were desired to use the instrument for studying high pitch sound waves.

Optical System

The lamp consists of a special 3.8 volt bulb made especially for this work by the General Electric Company to give a true line source. The light from this lamp passes through a lens to the mirror from which it is reflected back through the same lens to the film as described more in detail in N.A.C.A. Technical Note No. 22. In this instrument the lens was a simple one but better results would be obtained by using a corrected photographic objective.

The Film Drum

The film is contained in interchangeable daylight loading drums revolving once in two minutes, a detailed description of which is given in N.A.C.A. Technical Note No. 22.

The Driving Motor

The film is moved by an electric motor connected to the drum by a worm drive. This motor was developed, after a considerable amount of experimental work, as the most satisfactory means of driving a drum at a relatively high speed. This motor is of the direct current, series type and is held at constant speed by means of a governor as shown in Fig. 4. This governor will hold the speed to within 2% of constant for considerable changes in voltage and load. The motor runs on 8 volts, normally taking 1.6 amperes and will reach its normal speed in less than one-half second after closing the switch, with a starting current of 4½ amperes.

(Concluded on page 154)

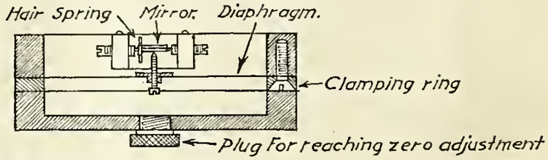


Fig. 2. Section of capsule.

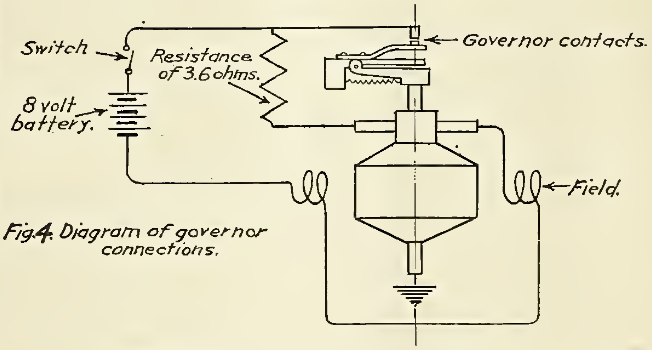


Fig. 4. Diagram of governor connections.

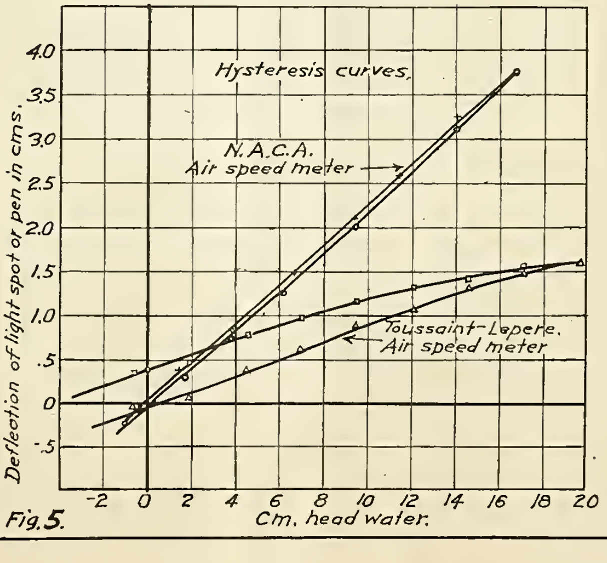


Fig. 5.

INFORMATION FOR PILOTS, GIVING THE PRACTICAL CHARACTERISTICS OF THE LAND ALONG VARIOUS AIR ROUTES

Mississippi

TUPELO, towards MEMPHIS, Tenn., mostly level, considerable timber, small streaks of red clay hills, landing fields few nearing MEMPHIS. Quite a bit of stump land.

TUPELO, towards MERIDIAN. Tupelo, air good, some timber, irrigation, but several safe fields. On way to OKOLONA, must cross small rough strip, mostly level, some timber, hilly country south and north.

OKOLONA to WEST POINT, country is very good for flying, north are red clay hills, south timber, lots of it, after thirty miles south. WEST POINT to ARTESIA, strips of timber, some emergceny fields 3,000′ altitude safe. ARTESIA to MACON, strips of timber but several open fields. MACON to MERIDIAN, country becomes more timbered, slightly rough. One place altitude 6,000′ needed to play safe. Field MERIDIAN only fair, air good all this section.

WEST POINT to ABERDEEN, mostly open, timber south of ABERDEEN, hilly east. WEST POINT to JACKSON, via STARKVILLE. To STARKVILLE, timber strips, becomes slightly hilly, then red clay hills, then towards JACKSON considerable timber, few landing places. Air good all the way.

WEST POINT to COLUMBUS. Timber strips, fairly level, safe altitude 3,000 feet. No place to land directly COLUMBUS, timber. COLUMBUS to MONTGOMERY, Ala., direct, only one trip made this route, miles and miles with no landing place, all timber and water (small rivers) from TOMBIGBEE, etc. COLUMBUS to ARTESIA, small timber strips, level, safe 2,000′. COLUMBUS to MACON, same. WEST POINT to MONTGOMERY, via DEMOPOLIS. Only practical route, West Point to Artesia, approximate to Macon, thence out southwest to TOMBIGBEE RIVER, over inland town of GAINSVILLE, Miss. This strip is lined with cotton fields, patches of timber, and is very good for emergency landing. Spring of year, danger along Tombigbee of mud and water in landing, south of T. B. miles of timber. GAINSVILLE is built in small hilly red clay section, surrounding north level. Southeast timber. Going towards DEMOPOLIS, yon now begin to enter more sparsely settled country, and more timber, still level. Safe altitude 9,000′ required in some places. Near DEMOPOLIS, breaks up again, as less timber, safe altitude 2,000′. (See Alabama).

Mississippi is well adapted for winter flying, but landing fields are scarce in spring and summer, due to the cultivation of crops, mainly cotton and tobacco. That land which is not under cultivation is swamp land or unfit to land upon. A safe landing can be made on plowed ground, but there are chances of a smash up on the take-off and the damage to crops will be on a large scale. In the winter months landing fields are abundant and flying can be done with ease over this country, although swamp land is extended over a great deal of territory.

Central and Northern Mississippi are good, but the western part is bad.

Lots of cotton along the river south of MEMPHIS in delta country—a few good fields here, but a line of hills runs from VICKSBURG, N. E. to GRENADA, then north, and all country south and east of these hills is no place for a ship—like western Tenn., a forced landing usually means a crack up.

A little good stretch from YAZOO CITY to JACKSON, but east of Jackson, broken timber.

Missouri

KANSAS CITY and vicinity, very wooded around here and generally very bad for pilots to fly over. The landing fields here are very small and rough and there are very few of them.

KANSAS CITY to LINCOLN, Nebr., alt. about 4,000, better landings after passing Nebraska line; trees, farms, some sand hills, several pastures, but some rocky.

Northern half of Missouri is all good land to fly over. A great part of it is practically level to slightly rolling.

Extreme western part near Kansas line is good.

The territory in Missouri shows landing fields frequently, and very fertile for the aviation industry. The bad portions of Missouri lie in the Ozark Mountains, and in the south central and southwestern parts of the state. Aside from this, Missouri is very flat, and the hazards are reduced to a minimum.

Central portion running from ST. LOUIS and KANSAS CITY is rolling and hilly for the most part, but a forced landing could be made all right. The territory around Kansas City is very hilly.

Northern Missouri is good, but southern Missouri is very bad, hills and trees.

From CHICAGO to ST. LOUIS the ground is very smooth, ideal as regards flying, only scattered groves, but with the Mississippi Valley soft during wet seasons. This country is subject to heavy rain storms with low fog and clouds at times, but only rarely impassable.

Leaving Forest Park Highlands, ST. LOUIS, one can follow the Frisco tracks to SPRINGFIELD, Mo. There are good fields all the way and gasoline and oil can be obtained. There is a field in SPRINGFIELD, but no hangars. Leaving Springfield, follow the Frisco R. R. tracks to MONETT, 48 miles. There is a small aeroplane factory here and hangars 1½ miles N. E. of town, where one can get parts, gasoline and oil. Leaving Monett follow the Frisco tracks due west to TULSA, Okla., 128 miles. Good landing fields all the way, mostly in 260 acre tracts. Gasoline and oil can be gotten at any town on the route.

Montana

The shortest pass into Montana is between COEUR-d-ALENE and the MISSOULA VALLEY at ST. REGIS and on the stretch there is no place where a forced landing could be made safely. East of MISSOULA the country is rough because of the main range of the Rockies between MISSOULA and HELENA, Mont.

Montana is broken by mountains and bad lands but due to the fact of some very careful flying in that state during the past year, there have been very few accidents, as one plane has flown for two years in that state with a very successful record, and another one in the northern part of the state has done exactly the same thing.

Altitude affects flying here—many landing fields. Maps show altitude and mountainous region. Always very windy, altitude flying different than ordinary flying. J.N.-4 with ceiling of 8,000′ will hardly get off ground at 4,000′ or take double run, also one cannot climb more than, for example, 800′ as bumps settle one, whereas if one started at sea level, he would be out of the way of bumps at 4,000′ and could go on up.

A J.N-4 was flown successfully at an altitude of 5,000′ and at BUTTE, by rigging it different, experienced flyers took off and flew J.N. at much higher altitude. Not so much effect on high powered planes. 3,500 ft., is good limit for J.N.

Nebraska

OGALLALA is situated on the very edge of the sand hills. There is a very level strip from here which continues east to the Missouri River and west to the Rockies, and in places in this section offers a fairly good landing field for a pilot. During certain seasons of the year certain pieces of ground cannot be landed on, on account of vegetation. South for 30 miles the country is level, then for 20 miles sand hills, then again it is level almost as far as Oklahoma line. North of here for 200 miles the country is sand hills, not always bad hills, but merely rolling country, where a forced landing could be made by a careful and experienced pilot. No swamp country in the state to talk of. However, northeast and southeast portions of the state are extremely rolling and would present some difficulty to a pilot not following carefully the level lines of the country. Central part of state is pretty good all the way through.

LINCOLN to OMAHA, only fair, some rocky country. LINCOLN to FREMONT, farms, some trees, fairly level. FREMONT to NEWMANS GROVE, same. NEWMANS GROVE to ALBION, quite a bit of timber, farms, more rolling. Field at OMAHA back of city.

Albion to Columbus, Neb., same.

Lincoln to Aurora, same.

Aurora to Broken Bow, more broken, hillier.

Broken Bow to Ansley, rougher, some sand hills.

Ansley to Ellsworth, sand hills, several long valleys intervening.

Ellsworth to Crawford via Alliance, first part choppy.

Alliance level, last part rolling, Crawford farms, and some rocks.

The entire route CHICAGO-OMAHA is perfect for forced landings. Landmarks are good. The air mail has a fine field at IOWA CITY, Ia. There is also a fine landing field on the north side of DES MOINES. The country from ATLANTIC to OMAHA is a bit rough, but from a reasonable altitude a landing could be picked without trouble. That is, the regular mail route, but one could also follow the Burlington R.R. Chicago-Omaha. As far as the Mississippi River the country is perfect for landing, but from there until the Des Moines River is reached at OTTUMWA, Ia., the country is rather bad, but with plenty of altitude a safe landing would be possible. From OTTUMWA the rest of the route is perfect.

From LINCOLN, Nebr., to ATLANTIC, Ia.. one can land at any time from 1,500 feet.

From CHICAGO - OMAHA over IOWA CITY the ground is very level with the exception of some very short distances in the vicinity of the Mississippi and Missouri Rivers. This country is subject to heavy rain storms with low fog and occasionally is impassable during the rainy seasons; it is also subject to blinding snow storms and very cold weather in winter, but rarely impassable from these.

New Hampshire

MANCHESTER, outskirts of city good.

From KEENE, N. H., to GREENFIELD, Mass., and RUTLAND, Vt., cross-country flying is very good and offers lots of chances to land if a pilot keps a safe altitude.

From GREENFIELD, Mass., to the Connecticut River as far as CHARLESTOWN, N. H., there are any number of excellent fields to drop into that were probably once a part of the river bed. For a distance of perhaps three or five miles on either side of the river there are good places to land in. On the way to PETERBOROUGH, N. H., from GREENFIELD, Mass., there are a few poor stretches about ten miles from MT. MONADNOCK, both on the GREENFIELD side and the PETERBOROUGH side. In the general direction of KEENE (from Greenfield) there are good fields. Keene itself is a good place to fly over because all the outskirts of the city are flat lands, which once formed a large lake bed.

From OLD ORCHARD BEACH, Me., to MANCHESTER, N. H., very good. Fields at MANCHESTER not very good. Thence to WORCESTER, Mass., very good. Excellent field there.

New Jersey

In the vicinity of TRENTON there are no particularly dangerous spots and a cross-country pilot would not have a great deal of difficulty in finding a place to make a landing.

Between NEW YORK and ATLANTIC CITY, starting from BELMONT PARK, L. I., country good all over Long Island. Best course to follow coast line to ATLANTIC CITY. This affords fairly good chance for forced landing.

ATLANTIC CITY via PHILADELPHIA to LANCASTER, Pa., fairly good country, good field at point near PHILADELPHIA. Country affords open fields and farm lands en route, and lots of good fields near LANCASTER. One field fairly good right in the city, F. & M. College Grounds.

NEW YORK CITY to PATERSON, N. J., some few good chances, but rather poor on the whole.

From PORT RICHMOND, S. I., to PRINCETON, N. J., fairly good, good field on canal about four miles beyond PRINCETON.

New Mexico

TEXICO to CLOVIS, level. CLOVIS to PORTALES, same, small sand hills on northeast, larger on south. ELIDA, or west from PORTALES, level to small sand dunes, rolling. ELIDA to ROSWELL, rolling to rough half way crossing Brazos River, more trees, then leveler and some irrigation. East of ROSWELL, rolling. West of ROSWELL, level ten miles, then foot hills, then mountains, from there to CAPITAN, mountains, altitude 5,000′ not safe. CAPITAN to CLOUDCRAFT, altitude 16,000 feet not safe, mountains. CAPITAN to CARRIZOZO, mountains and foot hills, rolling Carrizozo. CARRIZOZO to TUCUMCARI, same. CARRIZOZO to EL PASO, sand dunes, rolling to rough.

TEXICO, N. M., to CLAYTON, N. M., same as EL PASO, only gets level about Union County line, high altitude, air light. CLAYTON to TEXLINE, Tex., level. CLAYTON to DES MOINES, mountains 80 miles out from Clayton, rough, foot hills and pass. DES MOINES to TRINIDAD, rough, safe altitude about 5,000′ above ground.

The eastern half of this state is ideal flying country, practically one large landing field—rolling prairie, the greater part of it never having been broken, and the fences are few and far between, whereas the western half is mountainous and hazardous.

New York

Air route from NEW YORK to NORFOLK, Va., passing through TRENTON, PHILADELPHIA, WILMINGTON, BALTIMORE and WASHINGTON, there is good flying country, many large open fields.

ALBANY, country around here is fair.

LONG ISLAND is excellent country for flying. If one wishes to fly to WESTERLY, R. I., from GARDEN CITY he has a good route to go over. Crossing the Sound is absolutely safe at an altitude of 6,000′ to 7,000′ if the chain of small islands is followed.

NEW YORK to WASHINGTON, D. C., a good route to follow is: leaving MINEOLA, head toward SOUTH BROOKLYN, fly 3,500′ across to STATEN ISLAND, keep off shore to PERTH AMBOY. It is not necessary to trust the engine for about two minutes between the lower end of STATEN ISLAND and PERTH AMBOY. Pick up freight tracks, will bring you to main line P. R.R. "4 tracks," follow same to bridge across Delaware above PHILADELPHIA. This is the second crossing of the Delaware, the first is TRENTON. There are good fields all the way. At the bridge the pilot may skirt PHILADELPHIA, either to the right or left; if the left, he can fly down the river, having plenty of altitude. If taking the right, follow SCHUYLKILL to PARKSIDE AVENUE, PHILADELPHIA, then head for DARBY CREEK on right, thereby cuting off several miles. After passing PHILADELPHIA the tracks can be picked up again. Skirt CHESTER and WILMINGTON. At WILMINGTON, river curves, so follow tracks through ELKTON, Principo, Perryville, Havre de Grace to Aberdeen, where there is an excellent landing field.

There are two favorite routes for flying across the northern part of New York State. One is through SYRACUSE, ROCHESTER and BATAVIA to BUFFALO, the other through OSWEGO and down the lake shore.

From OSWEGO to ROCHESTER on the lake route beginning at OSWEGO, the country is rolling with the hills flattening out as one goes westward. Also the emergency landing fields are more numerous. Beginning at RED CREEK the land becomes more or less level and not so stony, larger fields are more common and it is generally better for flying. There is a good landing field at WOLCOTT, at NORTH ROSE and one at SODUS POINT. The country from SODUS TO ROCHESTER is also good.

The flying country from SYRACUSE to BUFFALO is very good, with the exception of the Montezuma Marshes, which are not very wide, but long. A safe altitude of 3,000′ should be maintained in flying over these. Fields along this whole route are large and level, and make for safe flying. Safe forced landings can be made at LYONS and PALMYRA.

Trip to HAMMONDSPORT, along the west side of SENECA LAKE, beginning from NORTH ROSE to GENEVA is very fine flying country, but after GENEVA is passed the hills begin and the landing fields are not so numerous, more woods are seen and the country is not nearly as good for flying. One may expect quite a bumpy passage over GENEVA if the wind happens to be in the south, as it gets a clean sweep the whole length of LAKE SENECA.

The western part of New York State is good flying country.

New York State, west of BINGHAMTON and about 75 to 100 miles north of the Pennsylvania border, hills and mountains are very numerous.

On the mail route NEW YORK-CLEVELAND there are few places a pilot could not make a forced landing without damage to his ship, although it is not impossible.

The country in the immediate vicinity of OGDENSBURG, N. Y., is, without question, excellent for cross-country flying and at a height of 3,000′ and with reasonable headwork on the part of the pilot should bring a plane to a safe landing without the slightest difficulty. The route from this city to WATERTOWN would also fall under this same category.

In regard to seaplane route from NEW YORK CITY to OGDENSBURG. The Hudson from NEW YORK to TROY is perfectly O.K. for any flying boat. Above Troy the river is narrow with frequent swift water spots and dams, as well as being crossed in numerous places with high tension wires strung at a considerable height above the ground.

The route from TROY to LAKE GEORGE requires two jumps over land of approximately five miles in length from GLENS FALLS to LAKE GEORGE. From then on the route follows the length of LAKE GEORGE with about a mile of land to be covered over TICONDEROGA to LAKE CHAMPLAIN, and thence along the length of this lake down the RICHELIEU and ST. LAWRENCE RIVERS. Follow the RICHELIEU to within a short distance of its junction with the ST. LAWRENCE, but a great part of this trip could be cut off by swinging over across a ten-mile strip over land to Montreal, providing the pilot is willing to maintain sufficient altitude to do it in safety. From MONTREAL to OGDENSBURG there are several stretches of rapids to be covered, but three thousand feet is sufficiently high altitude to clear them safely.

There is a field in TROY suitable for small planes such as the Curtiss J.N.-4 type and cruising around in this vicinity and places within a radius of 60 miles from the vicinity of this city; although there are no ready-made fields, there is always in sight a suitable place for a forced landing.

Between NEW YORK and ATLANTIC CITY, starting from BELMONT PARK, L. I., country good all over Long Island. Best course to follow coast line to ATLANTIC CITY. This affords fairly good chance for forced landing.

NEW YORK CITY, starting from ROOSEVELT FIELD, L. I., rather poor in event of forced landings, growing worse around vicinity of Delaware Water Gap and bad approaching SCRANTON, Pa. Heading toward ELMIRA, N. Y., rather better than before but still far from good, although there are fields for forced landings at WYALUSING and TONAWANDA. Fairly good country near ELMIRA. Lots of good fields a few miles west. Thence to OLEAN, rather poorer country, not so many fields.

NEW YORK CITY to PATERSON, N. J., some few good chances, but rather poor on the whole.

BUFFALO, N. Y. to ERIE, Pa., very good all along LAKE ERIE and good fields at ERIE.

ROOSEVELT FIELD to DANBURY, Conn., across Long Island, good. Across the bay to NORWALK, CONN., and thence to DANBURY, rather poor chance. Vicinity of DANBURY, rather bad and lots of hills.

ROOSEVELT FIELD to PRINCETON, N, J., fairly good. Good field on canal about 4 miles beyond PRINCETON.

The route NEW YORK-BALTIMORE-LANGLEY FIELD, Va. There is not much to choose in crossing NEW YORK HARBOR from LONG ISLAND to JERSEY—the only place to land is HUDSON COUNTY PARK in JERSEY CITY, a grass plot about 900′ long in the center. Following the Central and Pennsylvania R.R. tracks from JERSEY CITY through PHILADELPHIA, WILMINGTON, BALTIMORE to WASHINGTON. There are no landing fields until one gets past ELIZABETH and RAHWAY. From there on to TRENTON are flatlands with many good emergency fields. From TRENTON to PHILADELPHIA and for a radius of about twenty-five miles of this line each way, emergency fields are plentiful. This route is quite safe. PHILADELPHIA to WILMINGTON, along the river, is not so good; it is best to keep several miles inland, where there are good fields. The vicinity of WILMINGTON is good. From WILMINGTON to BALTIMORE is fair, fields are not as numerous as above, but are to be found within gliding distance of a 4,000′ altitude. Baltimore, the city is poor, and for several miles around it the landing field designated as such has not more than a 700-foot run, with obstacles and water on all sides. From BALTIMORE to WASHINGTON, same as from WILMINGTON to BALTIMORE. WASHINGTON to LANGLEY FIELD is a poor route at best. For a short distance out of WASHINGTON there are a few fair-sized fields which could be used, but they are very few and far between on the remainder of the trip. It is best to keep as far inland as possible, as the terrain is all cut up by cracks and rivers near the Chesapeake shore, and is very marshy and swampy.

LONG ISLAND, 3,000′ to 4,000′ will allow one to fly from central Long Island to Staten Island without danger. Fields in race tracks at Belmont (between Belmont and speedway) Speedway, vacant lots back of Coney Island, Newdorp. Some marshes near Jamaica Bay will allow a landing without much more than a nose over.

New York, good fields a short distance east of NIAGARA FALLS and BUFFALO, and generally in ERIE COUNTY, CHAUTAUQUA COUNTY has lots of its flat fields in grapes, but some good fields. East of these two counties, very hilly.

(*Concluded from page* 151)

Precision of the Instrument

The width of the line traced by this instrument is rather great, 0.010 of an inch, due to the poor quality of the lens. If readings are taken on one edge of the line the sharpness is sufficient to read within 1/1000 of an inch, which will give a precision of 1% when the deflection is only 1/10 of an inch.

In order to determine the hysteresis of this instrument its readings were compared with those of a water column when the pressure was increased and decreased. The difference between ascending and descending curves was nowhere greater than 2% of the maximum reading, and this would undoubtedly be greatly reduced under the condition of vibration which exists on the aeroplane. For the sake of comparison a similar run was made on a Toussaint-Lepère air speed meter with the pen resting on the paper in a normal manner. In this case the corresponding hysteresis error was 26% of its maximum reading. The two sets of curves are plotted in Fig. 5.

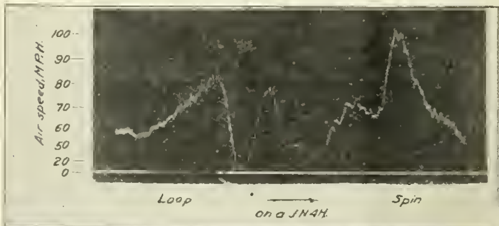
Several records are shown (Fig. 6) which were taken on a JN4H aeroplane in flight and it will be noted that even the high period bumps are recorded. In Fig. 7 are shown several records taken by speaking into the back of the capsule with the same diaphragm setting but with the drum revolving at a much higher speed. It will be seen that the sound waves are recorded very sharply even though the instrument was not especially lightened for this type of work.

Uses for this Type of Instrument

This instrument has been used successfully for recording the air speed in flight and for studying the flow in the wind tunnel, but by putting in other thicknesses of diaphragm it will be possible to use it for studying a large number of aeronautic and automotive problems. For example it could be used to study the pulsations of flow in an intake or exhaust manifold or the character of the sound emitted by various types of mufflers or the sound waves from a revolving propeller. For the latter uses this instrument has the advantage over a number of laboratory instruments designed for recording sound waves, in that it is portable and can be used under conditions of considerable vibration without having its readings affected.

Municipal Flying Field at Honolulu

There is a possibility that Honolulu may have a municipal flying field in the near future if arrangements can be effected whereby Honolulu Park may be extended to embrace an area 600 feet long and about 200 feet wide. Major-General Wm. P. Summerall, Department Commander, who with Brigadier General Joseph E. Kuhn made an inspection of possible landing fields in the vicinity of Hilo, stated that with the extension of Honolulu Park, as indicated, and the necessary preparation of the ground a hangar would be erected on the field and a detachment of enlisted men assigned for duty thereat.



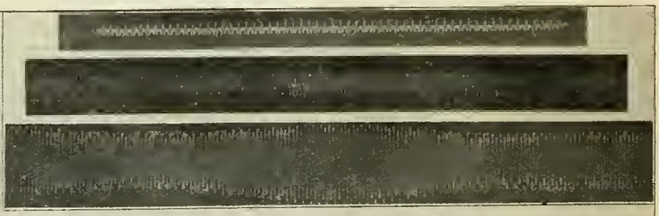


FIG. 7. SOUND WAVES PRODUCED BY THE HUMAN VOICE. ONE INCH HORIZONTALLY CORRESPONDS TO .048 SECONDS.

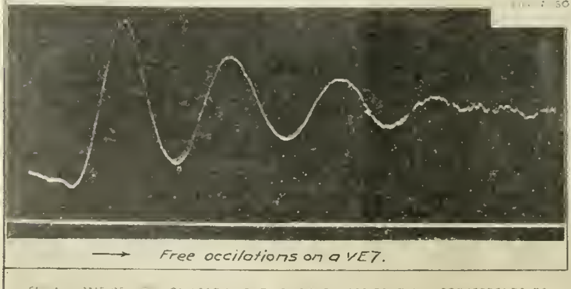


FIG. 6. SOME RECORDS ON FREE FLIGHT. ONE INCH HORIZONTALLY CORRESPONDS TO [illegible] SECONDS

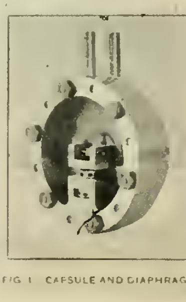


FIG. 1. CAPSULE AND DIAPHRAGM

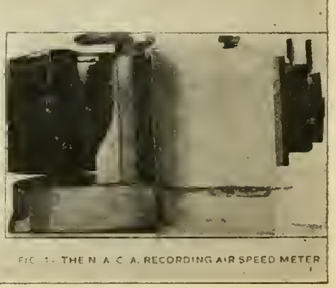


FIG. [illegible] THE N. A. C. A. RECORDING AIR SPEED METER

THE TRUTH ABOUT OUR AEROPLANE RECORD

By MAJOR H. B. HICKAM

(Through the courtesy of the Editars of Current History, published by the New York Times Company, we are enabled to reprint Major Hickam's authoritative accaunt af our achievements and failures in aircraft production during the war. The article originally appeared in the October issue of Current History).

It is doubtful if any phase of our part in the war has been more before the public than our "air program." Extravagant claims, bitter denunciations, investigations and reports of accomplishment, coming in rapid succession, have created a great confusion in the mind of the public and a general desire to know just what happened to the $640,000,000 and subsequent sums that Congress appropriated without question.

When the United States entered the war the "supremacy of the air" had become of vital importance. France and England were in desperate need of aircraft of all kinds and of personnel for their operation and maintenance. Their confidence in our ability to meet their requirements was great and apparently well founded, and they lost little time in making known what was required of us. *Our air program was dictated by the necessity of our allies,* and that necessity was fully impressed upon us.

Before the war ended there were many programs, each dictated by changing conditions, but the only one which is generally known and the one upon which our production is judged is the program of June 1, 1917, upon which the appropriation of $640,000,000 was based. On May 24, 1917, the French Government requested that we co-operate to form a corps equipped with 4,500 aeroplanes with the necessary personnel for operation and maintenance. As a result of this request, and realizing its importance, the Joint Army and Navy Technical Aircraft Board met on May 25, 1917, and reported to the Secretaries of War and Navy a program for carrying it into effect. The members present were:

Major B. D. Foulois, U. S. A.
Lieutenant J. W. Towers, U. S. N.
Captain V. E. Clark, U. S. A.
Asst. Naval Constructor J. C. Hunsaker, U. S. N.
Captain E. S. Gorrell, U. S. A.

This report estimated that to meet the needs of the United States Army alone, until July 1, 1918, the following numbers of training planes would be required, and it recommended that a building program to meet these needs be started at once:

Type of Aeroplane	Number Required	Type of Engine	Number Required
JN-4	3,500	OX-5	7,000
DH-4	1,750	R-R or equivalent	3,500
SE-5	600	H-S	1,200
Spad	600	H-S	1,200
Sopwith	600	Clerget 130	1,200
JN-4 (Stop gas order)	0	Hall-Scott A7a	1,000
R-4	200	V-2-3	400
R-6	350	V-2-3	700
Farman Seaplanes	175	H-S	350

The same report also recommended that the Aircraft Production Board of the Council of National Defense take steps immediately toward obtaining from Europe—as working models—two each of the following aeroplanes (including engines), with the right to manufacture them in this country:

DH-4
SE-5
Spad
Sopwith
BE-20 Farman
Farman Seaplane
Martinsyde
Sopwith 1½ Strutter
Handley Page
Caproni
Savoya

For the navy—in order to equip the coast stations and to train 330 pilots—the Joint Board estimated that the following would be needed, not including service aeroplanes:

300 School seaplanes with 100 H. P. engines.
200 Service seaplanes with 150-250 engines.
100 Speed scouts with 100-150 engines.
100 Large seaplanes with 200-400 engines.

To meet the request of France for co-operation in a flying corps of 4,500 aeroplanes—to be available for active service at the front during the Spring of 1918—the further needs of the United States Army were stated thus:

SERVICE AEROPLANES AND ENGINES (Latest Types)
(To be produced between Jan. 1, 1918, and June 30, 1918)

	Aeroplanes Fighting		Engines Fighting	
Types	Line	Reserve	Line	Reserve
Reconnaissance and artillery control	3,000	1,000	6,000	2,000
Fighting	5,000	1,667	10,000	3,334
Bombing	1,000	333	2,000	666
Total	9,000	3,000	18,000	6,000
Grand total		12,000		24,000

The recommendation of the Joint Army and Navy Technical Aircraft Board covering this service plane program was approved by the Secretary of War and the Secretary of the Navy about the same time as the recommendation covering training planes. The entire program then called for 8,075 training planes, 12,400 service planes, of which 300 of the training planes and 400 of the combat planes were for the navy, making the production as outlined for the army 20,475 planes in twelve months. The engine production estimate accompanying this plane program called for 41,810 engines in the year, with a maximum production of 6,150 per month.

Estimates were prepared after consultation with the French and British, and the total estimated cost for the program was $640,000,000. In the light of recent statements of the cost of the war that sum is not so impressive as it was when its appropriation was announced in headlines of every paper in the country. No such sum had ever been appropriated for any one purpose in the history of Congress, and it is small wonder that an admiring public pictured a sky darkened by aeroplanes. Congress had cerainly done its duty. The sum was necessary and it was appropriated without question and with no delay. The money was available, and it remained but to turn it into aeroplanes and to train the personnel for their operation.

Estimate of Our Situation

On May 12, 1917, the Signal Corps had on order 334 aeroplanes of thirty-two designs placed with sixteen firms or persons, *not more than six of which had ever manufactured mare than ten planes.* There were not more than forty officers and civilians who were capable of instructing in primary flying, and none of them had ever seen a modern fighting or service type aeroplane. No firm had ever produced anything but an elementary training plane, and there were not more than ten men capable of designing them. The situation with respect to engines was little better, although several far-sighted automobile manufacturers had experimented with aeronautical engines with some success. Most of the instruments and accessories of aircraft had never been heard of, and it was necessary to create a new order of instrument manufacturers capable of producing in great quantity, barometers, compasses, tachometers, speed indicators, angles of incidence indicators, thermometers, synchronizing mechanism, bombing sights, bomb release mechanisms, electrical gun and clothing heaters, automatic long range cameras, special radio apparatus and other super-sensitive instruments, the skill to make which did not exist in this country.

The program had been approved, the money appropriated, and the crying necessity for its accomplishment was only too apparent. The best of those whose previous experience seemed to fit them for the gigantic task were assembled and the fulfillment of our promises intrusted to them. These were men accustomed to success. No proposition had ever been too big for them, and they were determined to succeed. After a careful survey of the situation they were convinced that the program, huge as it was, was not impossible of accomplishment, and in their enthusiasm and determination they announced that they would carry it through. That announcement was transmitted through the press to every citizen of the country in such glowing terms that it can never be forgotten.

There is a popular impression that our air program was a failure, and that the money so generously and trustingly appropriated was squandered without adequate return. It is certain that if our accomplishment be measured by what we in our enthusiasm and ignorance announced we were going to do, then we failed, indeed; but if it be measured by the accomplishment of other countries under similar conditions, then even the most critical can find much cause for satisfaction.

As It Looked in 1917

The possible aircraft production facilities of the United States, as they appeared to thoughtful men at that time, were set forth on June 13, 1917, in a long letter written by Howard Coffin, Chairman of the Aircraft Board, to Brig. Gen. Kuhn, Chief of the War College Division. Though this letter is too long to print here in full, any one who will consult it in the War Office files will find it very illuminating. It shows that the early statements of what we could do were no vainglorious boasts, but were the result of a very careful analysis of the situation, based on all available information. Mr. Coffin outlined, item by item, how we apparently could and should go about the building of 5,000 training machines, 2,500 DH-4s for reconnaissance, 800 of each of three types of pursuit planes, and 12,000 fighting, bombing, artillery control and reconnaissance machines. He specified the aeroplane and automobile factories to which each type was to be assigned, and gave a complete list of thirty or forty others that could be enlisted in the work. The following passages show just how the situation looked and what was planned:

> We will concentrate on the reconnaissance and artillery control types, relieving French factories of the heavy production of these types. This will permit them to concentrate on fighting types utilizing the rotary engines. In the meantime, the rotary engine production will be materially increased in this country. With the U. S. 8 A and U. S. 12 A in quantity production before January 1, and the Lorraine-Dietrich by March 1, 1918, we can meet the increased reconnaissance and artillery control program. With designs from Europe on or before August 1, it will be possible to have planes in November from Curtiss and in December and January from sources of supply established to make training machines, but switched over to these as training orders are transferred to other new sources of supply. The output of these planes will temporarily exceed that of engines.
>
> It is estimated that production of these types will have to reach and hold 1,800 per month by March, 1918. The Curtiss Company has estimated they can reach an output of 30 per day, or 750 per month, of pursuit or fighting machines by January 1, 1918. We expect to have at least two other sources of supply equal in size and capacity to the Curtiss Company and to mobilize the productive capacities for wood working of some centres like Grand Rapids, Amesburg, Philadelphia and Camden, Cincinnati, Syracuse, Kansas City and St. Louis. * * *
>
> The automobile industry is producing 100,000 engines per month, while the maximum required by the aeroplane engine program is 6,000 per month.
>
> We firmly believe the aeroplane program can be met. We believe that the Aircraft Production Board can arrange for the production during the next twelve months of an engine for every plane and at least a spare engine for every five planes. The deficit in spare engines for training machines will be made up during the Spring and the deficit in engines for combat machines will be made up during the Summer of 1918.
>
> The problem of increasing the production of French and English factories has been suggested but there are so many questions involved in the transportation of all kinds of material, men, food, clothing, etc., that it seems best to defer an opinion on this point until our board has made an investigation of the subject abroad.
>
> The program as submitted to the Aircraft Production Board is a gigantic one, but capable of accomplishment as outlined, provided funds are quickly appropriated and no delays permitted.

Causes of Partial Failure

Why did fulfillment in some respects fall so far short of these expectations? The reason is that, careful as was the Aircraft Board's estimate, it was based in part on premises which afterward proved to be false. Chief among these were (1) the idea that engine production was harder to build up than plane production; (2) that the quantities of raw material needed were comparatively small and would not conflict with demands in other lines, and (3) that the manufacture of aeroplanes presented no special difficulties which existing factories could not easily meet. The rapidity with which planes and engines were becoming obsolete on the front also was not known, nor was it realized that difficulty would be experienced in getting the Allies to furnish sample planes and drawings for purposes of reproduction in this country.

The comprehensive inexperience of the United States in the manufacture of aircraft when we entered the war undoubtedly accounts for our overconfidence and for the heartbreaking delay in getting under way. The source of knowledge was 3,000 miles away, and development there was so rapid that it became necessary to go to the scene of actual conflict to gain our knowledge of what to produce. Perhaps it was fortunate that the difficulties which were soon to appear were not anticipated. Our advent into the war was at a time when the development of special types of aircraft for specific purposes was at its height. Planes which were considered adequate one month were inadequate the next, and the combatants were striving to outdo each other in design as well as quantity production.

Foreign aeronautical engines are mostly hand-made; all our engines are machine made. It is readily seen that all the advantage in changing design lies with the hand-made engine. If we were to go into quantity production it was necessary to select engines that would not become obsolete before they could be produced. The same thing applied in a lesser degree to plane manufacture. Our lack of aeronautical engineers with the necessary experience made it necessary to make "Chinese copies" of both planes and engines. Great care must be exercised, therefore, in the selection of what we were to duplicate. Early in the war the Bolling Commission was sent abroad to confer on the gronnd with our allies and to select and ship back the planes and engines that were to serve as patterns. This could not be done in a day. In the meantime we could not sit idle.

In the Curtiss JN-4 we had an elementary training plane which had given satisfaction, and except that many important shop practices were not of record but existed only in the minds of certain operatives of the Curtiss Company, the knowledge for production was at hand. Our program required large quantities of training planes at once, but after the initial supply had been produced only a small part of the industry would be required to replace wastage. The experience gained and the industry built up could then be turned to the production of service planes. Orders were placed with eleven different contractors, and production started.

The Liberty Motor

Early in 1916 the Simplex Company had obtained the design and rights for manufacture of the Hispano-Suiza motor. This engine was further advanced in standardization than any other foreign motor, and the Simplex Company had the advantage of the assistance of a group of foreign experts. It was not until February 6, 1917, thirteen months later, that the first motor turned over under its own power, notwithstanding the company had every inducement for rapid delivery. The General Vehicle Company had had a similar experience in the manufacture of the Gnome 110 H. P. Here were two significant examples of the time required to put standardized foreign engines into production. Both these engines were considered to be of the best when they were selected for production, but both were inadequate for anything but training before they could be got into quantity production.

With these examples before us it was evident that we could design and build an engine suitable to American manufacturing methods long before we could receive and duplicate any foreign engine. The idea of the Liberty motor was the result. Much criticism of the Liberty has been indulged in, but the wisdom of producing it is now so apparent as to make any comment unnecessary.

The Liberty motor is a combination of the best elements of American motor manufacture. Every secret of the industry was offered without reservation, and the Liberty, as its name indicates, is an enduring tribute to the patriotic spirit of American manufacturers. That everything that was offered could not be used detracts in no way from the splendid spirit that was shown.

As the development of types progressed, engines with increasing horse power were demanded. In May, 1917, our foreign advisers agreed that we should concentrate on an engine of about 225 horse power, and the Liberty-8 was designed to meet this demand. In less than three months development had been so rapid that all agreed that a horse power of 330 at least would be required. Fortunately, the development of the Liberty-12 had kept pace with that of the 8, and as a consequence the Liberty-12 went into production. The first type developed the required power, but before quantity production had well begun this was considered inadequate, and a redesigning of parts and many improvements resulted in an increase of over 100 horse power. The Liberty-12 today develops 440 horse power, and the end is not yet in sight.

Experience has shown that at least six months' service on the front is necessary to "get the bugs out of any new engine," but the foresight of our air service in the A. E. F. in preparing for the examination and test of the first engine to reach the zone of the advance, and the promptness with which suggestions for improvement were cabled home, shortened the expected time by months. These necessary and anticipated criticisms were given undue publicity, which resulted in much loss of faith on the part of of those inexperienced in gas engine development.

The difficulties encountered in going into quantity production were of a very serious nature. Existing motor building plants did not have machinery of sufficient size to handle the parts of a motor as large as the Liberty, and it was necessary to build and design tools for the purpose. Some 300 jigs, tools and fixtures are required to produce the necessary parts, and these had to be duplicated many times for quantity production. Thousands of men and women had to be trained and educated before they could be intrusted with the manufacture of parts which required a degree of skill they did not possess, and many of these were requisitioned for other necessary governmental activities as soon as they were trained.

Modern warfare demands the coordination of every phase of human activity, and all activities must be speeded up to the limit, notwithstanding the fact that many of the best and most efficient producers must be withdrawn for service with combatant troops. The draft, therefore, took many machinists and mechanics at a time when their services were vitally important, and fuel, transportation and materials had to be shared with those engaged in other phases of our military program.

First Deliveries of Engines

Production, however, started with the delivery, during December, 1917, of 22 engines of 330 horse power. After about 300 of these engines were in production the horse power was stepped up to 375. This required a strengthening of many parts and a change in many tools. Information from abroad indicated that if an engine of 300 horse power could be produced, the United States would lead the world in size and power of engines for 1918-1919.

After changes which necessitated a redesign of many jigs, tools, etc., and metallurgical changes in some of the parts which required the development of new and better methods of making steel, the Liberty went into final production with the enormous horse power of 440. So rapidly were these changes made that by May 29, 1918, one year after the date design was begun, 1,243 Liberty engines had been produced and delivered for service. Six months later the rate of production had reached the sum of 46,500 per year, and was increasing by leaps and bounds. On Oct. 30, 1918, our production rate of Liberty engines alone was far greater than England's rate of production for *all* her aeronautical engines.

Up to Nov. 29, 1918, a total of 15,572 Liberty engines had been produced, but that by no means represents the accomplishment in motor production, for the production of engines for primary and advanced training was over 16,800. In the month of October, 1918, America produced 3,878 Liberty 12s, 753 Hispano-Suizas, 309 Le Rhones, 357 other program types (OX-5, Lawrence, Gnome and Bugatti) and 32 experimental engines, a total of 5,329. The rate of production was increasing daily, and by Nov. 1, after eighteen months of war, we had reached a rate of 64,000 engines per year. A comparison with English and French production reports is illuminating. From the best available data, it is as follows:

ENGINES PRODUCED

	France	Italy	England	U.S.
1914	1,065	.....	99	11
1915	7,089	600	1,721	20
1916	16,785	2,400	5,363	134
1917	23,092	6,300	11,536	2,431
1918	44,563	15,000	22,102	34,241
1919	.....	.....	....	5,486
Total	92,594	24,300	40,821	42,323

During the years 1914-16, inclusive, the combined engine production of the Allies was only 35,122, yet they did not hesitate to demand that we produce 6,000 more than that number in one year, nor did we hesitate to promise to do so. During 1918 we actually did produce 34,241, and had we maintained the October production rate after the signing of the armistice we would have exceeded the demand made upon us. This is hardly a record of failure.

"Fighting Planes"

Probably the most bitter criticism of our air program is that "not one American-made fighting plane ever reached the front." It is small wonder that disappointment should be centered on this point. We entered the war to fight, and no small part of our effort was to be in the air. It is a fact that no American-made pursuit planes did reach the front. Acting on the advice of our allies, and finally realizing our inability to design and produce a pursuit plane capable of holding its own, we decided to leave the production of pursuit planes to the French until American engineers could master the new and intricate problems of design and production. In the meantime, we were to produce, for training purposes, American copies of the best models available anywhere.

The wisdom of this decision may be questioned by some, now that all the facts are available for study, but it is doubtful if even the most ardent critic would have decided otherwise had he been placed in the position of those who had to determine the policy.

No one except those who are actually engaged in the attempt to determine what to produce can ever realize the lack of definite information upon which to base a decision. Our source of information was 3,000 miles away, and the means of communication a cable choked with other essential business. During the six months from June to December, 1917, plans were made on information that afterward proved to be inadequate, necessitating change after change.

Signal Corps records show that from 1908 to 1916 the total number of planes delivered to the army was 54, while in 1916, due to requirements of the punitive expedition into Mexico, 366 had been ordered, of which only 64 were ever delivered. These were of the most elementary type. With this record of achievement of a starved and struggling industry, we were called upon to embark on a program calling for over 20,000 planes in a year. Of these, less than 25 per cent. were of a type then known to our industry. Of the remainder, we were without practical knowledge, drawings or designs. *In fact, we never at any time received a complete model or set of drawings.* "Millions may be appropriated in a day, but money cannot turn back the hands of the clock and permit the gaining of the experience and ability which make aeronautical engineers competent to undertake the vitally important problems which confronted us." (Letter of Colonel Waldron to Dr. Walcott.)

It was obvious that our only hope was to select the best of each type and to produce that until something better had been developed abroad or in the United States. Development, particularly in "fighting planes" or pursuit planes, was very rapid. Even those who had all the front-line experience could not look far enough ahead to determine future requirements. Planes representing the latest and best thought were often obsolescent before they reached the front. Confusion has resulted from the fact that planes such as the Spad, Nieuport, Sopwith and others retained their original name no matter how many changes or improvements were made in them. Critics demanded to know why we didn't select the Spad and turn it out in large quantities. It takes even a highly organized and well-trained industrial concern a long time to reproduce a perfect model, and longer to get into quantity production on it. Certainly we had no such concern available. The plane produced under conditions existing in 1917 would have been obsolete long before it left the United States.

Using France's Experience

The decision, therefore, was to furnish the French with raw materials and to have our pursuit aviation equipped with the latest and best plane that French engineers of long experience could produce with a highly trained, experienced and well-equipped industry behind them; an industry, by the way, that could not have continued in production without our raw materials. In no other way could our fighting pilots have the latest and best equipment during the year 1918.

A pursuit plane is very complicated in design. It must operate at sea level or at an altitude of over 20,000 feet; it must be fast and must climb rapidly, characteristics which are opposed to each other in design. A very delicate compromise is required to give the necessary performance. It must be very manoeuvrable, have good visibility and be well armed. Even today development continues very rapidly with no end in sight. No American engineer had ever seen one, to say nothing of having designed one. Yet there is still criticism because we turned over the production, in those early days of uncertainty and inexperience, of such planes to experts who unfortunately were French rather than American, but who, nevertheless, were allies fighting and working side by side with our pilots in a common cause.

We actually did bend every effort toward the design of an American-built pursuit plane, with the result that the first design of the MB-3, now recognized as one of the best in the world, was turned out and tested early in 1919. There were others just as promising in sight, but, while there was American ability in plenty, there was no *time*.

There are two general classes of planes required—elementary training planes, in which pilots are taught flying, and service planes, in which they operate over the front lines. There are, again, two general classes of service planes—air force, i. e., pursuit, bombardment and attack, which apply force from the air, and air service planes, which serve the different elements of the army by reconnaissance, liaison, spotting artillery fire, etc. The duty of the first class is to fight;

the second class fights only for self-protection, to enable its mission to be carried out in spite of attack.

The Bolling commission reported that the British DH-9, which was just emerging from the experimental stage, had reached a degree of development which would enable it to give excellent service, no matter how long the war might last. This was an air service or observation plane, which could also be used as a light day bomber. If we could produce this in large quantities, we could turn out equipment that would always be useful, even though a better plane might be developed. Here was something we could go ahead on with confidence, if we could get a model or a set of production drawings. This was, however, impossible at the time, so the determination was made to go into production on the DH-4, which was then in use by the British in the front and continued in use, by the way, until the end of the war.

Success With Observation Planes

On Aug. 15 the first DH-4 arrived at Dayton. It was without engine, ordinance and many accessories for its use. A set of incomplete drawings accompanied it. The fuselage design had to be changed many times in order to accommodate the Liberty-12 and the instruments and accessories necessary for its operation. On October 29 the first DH with a Liberty motor was flown successfully, and during the next four months the infinite complications of installing the equipment demanded were solved and production started with the delivery of fifteen machines in April, 1918. By October the rate of production had reached 1,097 a month. In the meantime, many changes and improvements had been made as the result of criticism and recommendations from the A. E. F.

On Nov. 11, 1918, 196 DH-4s were actually in use at the front, 667 had been received at the front, 293 were at A. E. F. training schools out of a total of 1,440 planes actually received in France, and 1,040 more were en route. A total of 4,846 had been produced. With the exception of 100 Handley Pages shipped to England for assembly, this represents our total production of planes for service at the front.

Our program for the production of service planes called for 12,000 of three general classes. This really meant about 18,000, for about 50 per cent. spare parts were considered necessary for maintenance. This item may represent in a small way our ignorance and inexperience in May, 1917. These planes were to be produced between Jan. 1 and June 30 if we were to fulfill our promises. Had we been informed of the maximum rate of production that France and England, with their years of experience under pressure, had been able to attain, the absurdity of such a program would have been evident. The following table, taken from published reports, gives the plane production of the Allies:

AEROPLANES PRODUCED

	France	Italy	England	U. S.
1914	541	.....	245	11
1915	4,469	400	1,932	20
1916	7,549	1,300	6,149	83
1917	14,915	4,000	14,421	1,807
1918	23,669	6,500	32,106	11,916
1919	.....	....	.....	409
Total	51,143	12,200	54,855	14,246

During the years of 1914-16 the combined production of the Allies was only 22,585, yet we were expected to produce as much in one year, and that with practically no previous experience. During the year 1918 we actually did produce 11,916 planes—more than the entire production of either France or England up to the time we declared war.

While our production was getting under way, training and service machines were needed by the air service in the A. E. F., and it was recognized that for many months it would be impossible to meet this requirement with planes manufactured in the United States. Accordingly, orders were placed with French factories for 5,875 planes of French design, with delivery promised by July 1, 1918, and promises were made to the French industry for the delivery of great quantities of raw material. Neither the United States nor the French Government was able to fulfill its promises. *However, 22,500 tons of raw materials and fabricated parts were furnished the French,* and 4,791 planes were delivered to the air forces of the A. E. F. before Nov. 11, 1918.

There have been many statements to the effect that American aviators flew planes of obsolete type turned over by the French, but records of delivery show that we fared even better than the French themselves. It requires about a year before a plane which is accepted as an improvement replaces equipment on the front, and there have been many cases of planes becoming obsolescent before they ever reached quantity production. These planes were used on inactive sectors and for training, and it was only just that we take our share of such equipment. After July 1, 1918, we received nothing but planes of the most approved type.

Furnishing Raw Materials

Our accomplishments in production, however, can by no means be measured by the number of planes produced. We had to furnish all the spruce, and later much of the fabric and dope, as well as wire and steel fittings, for France, England and Italy. A preliminary survey disclosed an appalling shortage of spruce, linen, castor oil and acetate. The failure of any one of these essential raw materials could cause the collapse, not only of our own program, but of that of the Allies as well. In meeting such problems we were in our element; given a reasonable amount of time, they could be solved, but time was the essential we lacked. *Already we were attempting to crowd the development of ten years into as many months, and any delay would be fatal.* Judged by peace-time production costs, many of the expenditures made may seem excessive, but the value of time can be measured only by the pressure of necessity, and certainly our necessity justified the expenditure of any sum required to produce results in time.

Acetone is necessary for the manufacture of cordite, an explosive upon which the British were absolutely dependent. Our aircraft program called for 25,000 tons. Estimates showed that the total available supply would not even meet other demands. One of the essential products was totally lacking. The entire supply of acetate of lime, as well as that of other refined ingredients, was commandeered; 170,000 tons were required, and only 106,000 were available. The requirements of all the Allies were pooled, and the best chemists in the country were secured to master the intricate technical requirements of production. Many previously unconsidered sources of supply had to be discovered, and after large chemical plants had been developed by governmental support, the demand was met, and 1,324,356 gallons of dope were manufactured from original sources which proved to be more than adequate for all requirements.

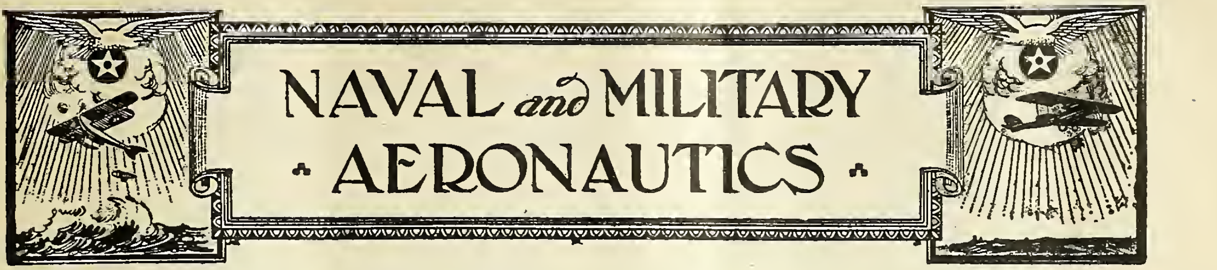
As early as the Spring of 1917 a serious shortage of aeroplane spruce had developed, and in order to secure spruce fast enough to meet our own and allied production needs, the Spruce Production Corporation was organized in the Pacific Northwest. New and hitherto inaccessible sources were opened up in order that the flow or aircraft lumber might not stop with the exhaustion of the accessible supply. The problem of procuring spruce for aircraft presented new problems to our lumber interests and too much credit cannot be given for the manner in which they were solved. Education in new methods of logging, sawing, drying and utilization of spruce was necessary, and the knowledge gained in the solution of the many and varied problems will be of lasting benefit. As a result of improved methods the requirement per machine fell from 5,000 feet to 1,000 with a consequent reduction of expense in all departments. Over 180,000,000 feet of aircraft lumber was shipped, *of which* 120,000,000 *went to our allies* and 60,000,000 to our own industry.

With the collapse of the Russian Government, one of the two great sources of linen was lost, and by December, 1917, it was realized that the air program of the Allies as well as our own would depend upon the development of a suitable substitute. England's reputation as the greatest cotton-manufacturing centre of the world is well established, but the cotton fabric used as a substitute for linen was developed in the United States by our own experts to meet the needs of our own program. The physical characteristics of our cotton fabric equal those of the best linen, and it was produced at just half the cost. Had not American genius produced a substitute superior to the original, after years of England's best effort had been unsuccessful, our program would have been brought to a full stop before it had well begun. In August, 1918, our production rate was 1,200,000 yards per month, and every yard meant a saving of 65 cents.

Important Discoveries

The castor oil situation was very similar to that of linen and acetone. Before Liberty Aero Oil was developed, castor oil was the only satisfactory lubricant for high speed motors and the quantity required for our program was enormous. The Government's country-wide round-up of castor oil robbed every small boy in the United States, but had not the Lubrication Division succeeded in developing a satisfactory mineral oil for the Liberty and other stationary engines, the supply would have been utterly inadequate.

Wherever our industry could obtain adequate knowledge of what was required, there is no record of failure. Had it been possible to make the American people acquainted with the true condition in 1917, and had they been kept informed of difficulties as they appeared and of the steps taken to overcome them, the feeling in regard to our aircraft production would be one of pride rather than of disappointment.



NAVAL and MILITARY AERONAUTICS

Army and Navy Estimates

Washington.—Estimates for Army and Navy Air Service, which have been sent to Gen. Charles G. Dawes, Director of the Budget, call for appropriations aggregating $30,000,000 for the fiscal year beginning July 1 next.

Last year estimates for the two services aggregated $70,000,000, and Congress appropriated $33,613,431, of which the army received approximately $19,000,000 and the navy about $14,500,000. As heretofore announced the Army Air Service estimate is for $13,000,000, while that for the navy in $17,000,000.

France this year is spending $58,816,684 on aviation, and England $92,378,836. The British estimates for next year are said to be $113,757,024, while the French estimates for 1922 have not yet been received.

Japan plans an expenditure of $19,685,260 on aviation in 1922, and has a seven year air programme calling for an expenditure of $200,000,000.

In the light of what other Governments are doing in the way of aviation development, present and prospective, American flying men are not at all happy over the prospect of still further reductions in appropriations. These they feel already have been cut below the point of safety, especially in view of the showing made by army and navy aircraft against the former German warships off the Virginia Capes during the summer, and by army aircraft against the old battleship Alabama in Tangier Sound, Chesapeake Bay, last month.

It is felt that the $13,000,000 proposed for the Army Air Service will do little more than cover the cost of operation and upkeep. Flying officers point out that the cost of operation is necessarily much higher because of the large amount of old material and equipment left over from the World War.

Should Congress show a disposition to be more liberal, doubtless both aviation services will be prepared to submit further estimates. For example, while the estimates for the navy are about $2,500,000 more than the appropriations for the current year, the fact that the personnel must be paid out of this fund next year, in effect, would mean an actual reduction if Congress should grant the full $17,000,000 asked for.

This amount would enable the Bureau of Naval Aeronautics to keep up its reduced establishment and carry on a curtailed programme of advancement. Experiments are now being conducted with new types of planes with a view to developing one that can land on the deck of a battleship.

Naval Fliers Fight Cut in Rank and Pay

Norfolk, Va.—Congress next week will receive a strong protest from naval aviators who have served America since the war, many of whom were notified October 14 that they had failed to pass an examination held last May and either would be reduced in rank, with a corresponding reduction in salary, or dismissed from the service.

More than 385 men, comprising the entire Naval Reserve aviation force, are affected by the order. Out of sixty men at the air station at the Hampton Roads naval base only fifteen passed the examination and none of them will retain his present commission as Lieutenant.

The aviators declare they have been badly treated by the aviation officials of the Navy Department. They say they were required to stand an examination on matters that had no bearing whatever on flying, 70 per cent. of the questions they were required to answer pertaining to the navy, seamanship and knowledge of a battleship.

It is stated that aviators who have made the best records of any flyers in the world and who never had been on a warship were asked to explain various parts of a ship and the duties of a sailor.

The men say they joined the Aviation Corps to fly and they know their business perfectly. They admit they know little or nothing about a warship and do not believe they were treated fairly in being required to stand an examination in which only 30 per cent. of the questions relate to flying.

The reservists charge that the Navy Department is "sacking" its best aviators to make room for "rookies from Annapolis." Aviators who since the world war have held commissions as lieutenants, who passed the "nautical examination," have been reduced to ensigns. Young recruits from Annapolis, without any experience as aviators, will receive the same commissions as the old flyers and will outrank the reservists who manage to "retain their scalps."

Under the orders from the Navy Department such aviators as Lieut. Hinton, who piloted NC-4 across the Atlantic Ocean; Lieut. Laval, winner of several aviation endurance honors and Lieut. Williams, who made an excellent record in the bombing manoeuvres recently held off the Virginia coast, are reduced to the rank of ensigns.

Under the old arrangements aviators were rated according to their experiences. The man who had the greatest number of hours in the air to his credit, in conjunction with long service, was first in line for promotion. Some aviators who have been in the service for four years have as much as 1,200 hours in the air. The average, however, is about 750 hours. Lieut. Hinton is said to be among the first aviators of America or any other country with more than 1,000 hours in the air to his credit. His record as a pilot is second to none in America.

Lieut. Laval was one of the leading competitors in an international aviation contest and finished among the winners.

In the recent bombing off the Virginia Capes in which the navy participated, all the planes were manned by reserve officers. The best records were made by reserve officers, and the best time was made by machines manned by the reserve forces. America depended on the reserve forces during the experiments for an efficient air corps, it is asserted, and the officers do not believe they should be "sacked" now to make way for Annapolis recruits. The officers say the department plans to send Annapolis recruits to an aviation school at Pensacola, where they will be trained three months in the art of handling air machines. At the end of that time they will receive commissions as ensigns and be sent to naval air posts, where they will be placed over older and more experienced aviators.

A petition is being prepared by reserve aviators to be presented to Congress and to the Navy Department. The aviators want the department to order another examination, with the questions based on flying, the upkeep and mechanism of air machines and other things that experienced airmen should know.

Senators who will take the aviators' case before Congress are Penrose of Pennsylvania, Swanson of Virginia, McCormick of Illinois, Wadsworth of New York, Simmons of North Carolina and others. Aviators from all over the country already have written to their Congressmen to take up the matter with the Navy Department. A delegation of airmen, representing every navy station on the coast, will visit Washington to present their case in person to Congress.

Fleet Will Test Anti-Aircraft Guns on Rag Men in Gliders

Norfolk, Va.—Rag men will be used to "man" a fleet of gliders that will be under fire of anti-aircraft guns on ships of the Atlantic fleet in forthcoming maneuvers off the Virginia Capes and Cuba the latter part of the winter. It is planned to launch the gliders from navy dirigibles at a height of from 3,000 to 5,000 feet. The rag men will be fastened in the gliders to prevent the machines from turning over in the downward flight they will take after they are released. The presence of the rag men in the gliders will also give American gunners using small arms a chance to prove their marksmanship in picking off crews of an aerial enemy craft.

It is proposed to release the gliders in groups of five. Naval experts say the gliders, in their flight downward, will maintain an average speed of about forty-five miles an hour, about half the speed an aviator in full flight would average in an attempt to escape gunners on warships after delivering an attack.

Practically every ship in the Atlantic fleet will take part in the attack of the gliders.

An elaborate program of aerial target shooting and maneuvers is being prepared for use when the Atlantic Fleet goes to Guantanamo the coming winter. Most of the fleet will assemble off the Virginia Capes within the next few weeks for preliminary target practice, which will include experiments with gliders and box kites. The latter style of targets has been used in previous aerial target shooting and resulted in excellent records for navy gunners using small arms. Box kites are made fast to ships with ropes and permitted to soar at heights varying from 500 to 1,200 feet.

The gliders will be larger than those used in land maneuvers by the army and navy. Each glider, it is said, could easily carry two live men with utmost safety.

FOREIGN NEWS

Air Customs Fleet to Patrol Channel

A new aviation problem has developed here which probably will be solved by the organization of a squadron of flying customs inspectors. Numerous forced descents on the cross-Channel air route have been observed to be marked by the disappearance of certain passengers, and the police are convinced that such incidents are really attempts—usually successful—to smuggle in valuables from London, Brussels and Holland, chiefly cut gems, which find a ready market here.

The law says that when a machine is forced to land outside the appointed landing area all passengers must remain with their baggage untouched until the customs police arrive. In most cases, however, this would require remaining in the cabin of the planes over night, as few direct trains follow the route taken by the aeroplane service.

Most of the customs officials are loath to risk their lives in planes, and have consented to the formation of a special air division which will be called by wireless from Paris or Boulogne whenever flights must be abandoned owning to defective machinery.

Aviation in India

The Air Board of India, under the Commerce Department, is a purely advisory body without executory functions. As soon as funds are available, the Government of India has decided to prepare a trunk air route from Rangoon (via Calcutta and Allahabad) to Bombay. When this route, or a section of it, is completed, tenders will be called for an air mail service over the completed portion. Local governments in India have also been empowered to lay out air routes within their own boundaries.

Airdrome Police in China

For the purpose of maintaining peace and order of airdromes the Aeronautical Department has recently organized an Airdrome Police Training Corps, which consists of 160 men divided into four groups commanded by a commander-in-chief. The work of this new organization was completed on June 1st. When the Pekin-Shanghai air-line begins its service these policemen will be sent to different airdromes for duty.

The Aeronautical Department has engaged four new pilots from England and America for service in connection with the Pekin-Shanghai air service, which, according to latest reports, was scheduled to start on August 1st. These pilots are Captains Jones, McMullin, Campbell Orde, and C. H. Dolan.

The five students sent by the Aeronautical Department to England to study aeroplane construction have completed their courses after one year's hard study. Three of these students have been assigned to the Tsin-ho Aircraft factory, where technical experts are needed. The remaining two were ordered to America to continue their studies in Military Aviation.

Franco-Roumanian Agreement

The Roumanian Minister of Communications has been authorized to sign a contract with a French Company, the Franco-Roumaine de Navigation Aerienne, under which the Company has the right of air transport in Roumania on the Paris-Strasburg-Prague-Vienna, Budapest-Belgrade-Bucharest-Constantinople air route over a period of 20 years. The agreement carries with it an annual maximum subsidy of 6,500,000 lei to the Company in return for certain guarantees, including the placing of its material and personnel at the disposal of the Roumanian Government in the event of mobilization.

Japanese Aviation

The program of the Air Bureau includes the consolidation and encouragement of civil aviation, the supervision of private undertakings, and the establishment of an international air route. Civilian pilots are to be trained at the military Aviation School, 292 applications having been received for 10 vacancies available in 1921.

German Aviation

The following special article in the New York *World* is of interest:

Germany's first air traffic timetable has just been published here. It contains many interesting facts about the development of Germany's peaceful air fleet, which leading air navigation experts claim will become a strong competitor of the republic's newly organized railroad system at the very moment that the Entente lifts the ban on the building of planes intended for peaceful air traffic.

The Versailles Treaty forbids Germany to manufacture aeroplanes or parts thereof, nor is she permitted to import air navigation vehicles of any sort. Germany was furthermore required either to deliver to the Entente or to destroy her entire air fleet, numbering about 10,000 machines.

To-day Germany is rebuilding on the wreck of the old an entire new air fleet of modern construction. Just as the old engineers of the Hamburg-American Line and the North German Lloyd provided for plenty of space and comfort when they planned the construction of their prewar passenger steamers, the modern aeroplane factories of Germany are equipping their planes with large, comfortable cabins and staterooms. The marvellous success of the extended air service which enterprising flyers and aeroplane builders started only a year ago may be ascribed to the generous support given it by the great industrial magnates and steamship companies like Hugo Stinnes, the Hamburg-American Line and the North German Lloyd.

In the first eight months of this year 3,714 scheduled flights were made, against 1,878 flights in twelve months the year before. This not only indicates that this year more flights were made compared with last year but also that new air routes were opened and more planes were added to the fleet. The German Air Navigation Service, as the associated enterprises call themselves, has to-day again 150 aeroplanes of one type or another at its disposal.

The new air service schedule just published shows that Berlin has been made the centre of all important air routes.

From Berlin there are daily trips to and from Brunswick, Dortmund, Dresden, Hamburg and Bremen, extended by the Baltic Air Service of the Sablatnig aeroplane firm to Travemuende, Warnemuende and Sassnitz, making connections with the steamers leaving those towns for Sweden, Norway and Denmark.

Then there is the Danzig Air Service, which co-operates with the Sablatnig service in maintaining the flying routes between Berlin and and the East Prussian route—Danzig, Koenigsberg, Memel—with connections at Riga and Reval.

The Lloyd Air Service Sablatnig has an additional route from Berlin to Westphalia, Muenster, Bremen, Wangerood.

The Rumpler Air Service provides planes for the Berlin, Leipzig, Nuernberg, Munich, Augsburg route, and at Munich the Bavarian Air Lloyd provides transportation facilities by air to Constance.

Another direct service between Stuttgart and Constance is furnished by the Staehle Air Line.

Then there is the Deutsche Luftllloyd, which has several planes travelling daily from Berlin over Magdeburg to Hamburg and Bremen, and from Bremen over Magdeburg to Leipzig and Dresden. At Hamburg and Bremen connections can be made with Dutch and Danish air lines for Amsterdam, Rotterdam and Copenhagen. From Amsterdam and Rotterdam, French and English planes take passengers to London or via Brussels to Paris, where air connections can be made for Spain.

The schedule contains all the different air service lines established in Europe up to August, 1921, as well as the different prices charged by them. Although the price for benzine and gasoline is much higher in Germany than in all the other countries the fares on the German air lines are the cheapest.

Travellers coming to Berlin can fly for two hours all around the surrounding districts for 200 marks—about $2 at the present rate of exchange. This price even includes the automobile from the offices of the Hamburg-American Line or the North German Lloyd, both of which are in the downtown district, to the flying field, some ten miles out of town.

A ticket from Berlin to Amsterdam costs only 450 marks and 75 gulden; from Berlin to Brunswick, 350 marks; from Berlin to Bremen, 450 marks; to Danzig, 900 marks; to Augsburg, 1,725 marks.

So far 5,581 persons have been transported by the regular air service this year. During all of last year only 2,030 persons were carried.

This shows how rapidly the new air passenger service is developing in Germany in spite of the prohibitive articles of the Versailles Treaty.

The Brussels Meeting

On Sept. 3rd-4th the Aero Club Belgique held a meeting at Brussels, the two principal events being a Belgian Flying Corps Squadron Race for "La Coupe Challenge des Escadrilles" and a race for touring aeroplanes under 100-h.p. for "La Coupe Simonet."

The former race was held over the course Brussels-Ostend-Brussels, and resulted as follows:—Single-seater: 1st, 1er Escadrille Technique; 2nd, 10e Escadrille; 3rd, 9e Escadrille. Two-seaters: 1st, 2e Escadrille Technique; 2nd, 6e Escadrille; 3rd, 2e Escadrille.

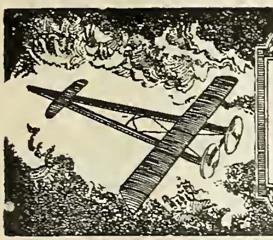
"The Coupe Simonet", a competition for sporting or touring aircraft possessing qualities of economy, ease of dismantling, variation of speed, etc., resulted as follows:—1st, Bossoutrot (Farman-Sport), 63.9 pts; 2nd, Van Cotthem (Central Aircraft Co. "Centaur 4"), 53.3 pts.; 3rd, Pelletier d'Oisy (Morane-Saulnier), 45 pts.; 4th, Mlle Boland (Caudron), 44.4 pts.; 5th, Martin (Avro "Baby"), 35.5 pts.

Aviation in Australia

Probably Canada is the most forward of the Dominions in the development of aviation, but Australia seems determined not to be left behind in the race. According to a Sydney correspondent of *The Times* Trade Supplement, the Commonwealth Government has now decided upon a definite line of policy, and, as a first step, practical encouragement is to be given to the manufacture of aircraft locally. The Australian Aircraft and Engineering Co., of Sydney, has been firmly established and the Government has placed with it an initial order for six machines of the 504 K Avro type. The works are adapted to rapid expansion, and the industry is expected to grow, especially as commercial aviation develops. The only materials that will have to be imported for the construction of the machines noted will be the fabric, ball bearings, steel bracing cables, and a certain amount of raw steel for making component parts. The 504 K type has been adopted by the Government as a standard, and a sufficient number of these machines, together with all necessary spare parts, is to be maintained at all the State training centres.

Last year the Commonwealth Government passed a measure to regulate and legalize air traffic. Machines, before being placed in commission for passenger services, are to undergo an inspection and test on the lines now familiar at home, while pilots have also to pass an examination in regard to qualification and physical fitness. The Civil Aviation Branch of the Defence Department has approved the establishment of aerial mail services between Sydney and Brisbane and Sydney and Adelaide. Tenders are being invited from private companies willing to undertake the work, while the Government has already accepted a tender for an air service between Geraldton and Derby, in Western Australia, a flying distance of 1,200 miles. All the services are to provide for both mails and passengers.

All this is very encouraging, showing as it does that the potentialities of aerial navigation are fully appreciated at the Antipodes. The beginnings are small, it is true, but all things must have a start. We think the Australian Government is to be very much congratulated upon its early enterprise. It is getting going in earnest, and as the Commonwealth is essentially a country in which aviation can do an enormous amount of good by opening up communications where none now exist, we look forward to very great developments within the next few years. Australia should be well in the front rank of commercial aviation before many years are past.—*Flight.*



ELEMENTARY AERONAUTICS and MODEL NOTES

How To Make a Scale to Measure Thrust

MODEL propellers should be tested to show just how many ounces of thrust the propeller is giving. In this way the poorer propellers can gradually be discarded when they are seen to give but little thrust by comparison with others. The selection is simplified by the home-made scale illustrated here.

By means of this scale, instant readings are shown in a way that should make it a part of every builder's outfit—it is simply hooked on to the rear of the model as it rests in position for flying, and when the propeller or propellers are released, the spring stretches to the various marks previously made on the scale. As there are but two wires and a spring required, the materials are not very elaborate. The tools required are a pair of pliers for bending the main rods, a hand drill and No. 60 drill for the two spring holes, a hammer to flatten three of the rod ends, and a file for marking the "scales" on the rods.

The sketch will be sufficient to show the arrangement, and the sizes and materials can vary according to those most available or desired. The suggested length, however, is not less than 8 inches overall. The spring can be two and one-quarter inches long, ⅛" in diameter. The spring may be of music wire No. 8 gage (American Steel & Wire Co's. gage) which is .020 diameter. Brass rod makes the best frame as it is easy to bend, flatten and drill; a diameter of 3/32" will do.

The spring can be formed by winding the steel wire around a ⅛" nail. This is best accomplished by turning the nail in a hand drill while the wire is fed onto it tightly.

First bend the rods with the hooks arranged so that the pull will be directly from the centers of hooks, and passing through the axis of the spring. This eliminates uneven working and the resultant inaccurate results. The flattened ends clamping around the rods should allow the rods to slide freely. Marks are left until last; they can be determined by weighing a 1 lb. weight.

When the zero and 1 lb. marks are found by weighing, the ounce marks are easily made by dividing the distance between the two original marks into 16 equal divisions, each one representing an ounce. In the same manner, marks can also be made on the sliding rod, to indicate the fractions of a pound by 4 ounces each or ¼ of a pound. Carefully placed lines are filed on the rods as the indicating marks.

As an example of how the spring stretches in proportion to its diameter and length, it was found that a spring of No. 8 steel, in a coil ⅛" in diameter and 1⅛" long stretches to 5" with a weight of 10 ounces. Some tests on model thrusts made with such a scale as this, originated by George Page, holder of many model records some years ago, showed that for the average rubber driven or compressed air driven model, the thrust should equal one-fourth of the weight of the model, or the model will be under-powered. A model weighing 1 lb. should have a thrust of not less than one-quarter of a pound, and so on.

Another feature which is brought out strongly is the manner in which the thrust drops off as the power is diminished. For the first few seconds the highest thrust is recorded, but the thrust very quickly drops at an increasing rate as the motor unwinds.

One very important point must not be overlooked, and that is to use a spring, which will stretch considerably with but little weight, for then the readings can be more accurately read. A hard, heavy, stiff spring will only move a short distance to record a full pound, and obviously the finer readings, such as ounces, cannot be observed at all.

Such a scale as this is also very handy to weigh up the parts of a model, for the ordinary small spring or balance scale does not show the weights in ounces.

Monoplane Wings

Principally on account of a number of accidents due to faulty designing, the monoplane has not been as widely used as it should have been. There are several important advantages inherent in this type of wing construction. Aerodynamically, a monoplane wing is much more efficient than a biplane or triplane wing.

From the standpoint of visibility a monoplane wing is excellent because there is no interference from the lower wing. If a pilot is so placed that his eye is on the level with the wing of a monoplane, his "blind angle", due to the wing interference, is very small.

Even an externally braced monoplane cellule is much easier to assemble and true up than a biplane cellule, while an internally braced monoplane wing offers no rigging difficulties whatever.

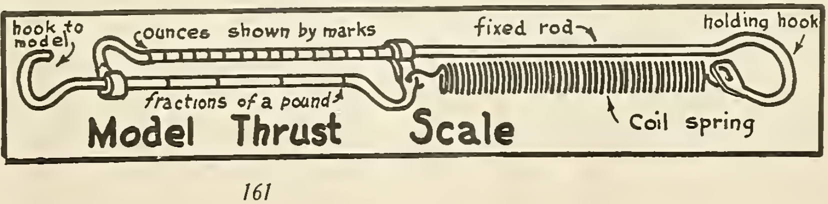
Monoplanes braced by complicated trussing are entirely obsolete. If external bracing is employed, it should consist of struts or wires from the front and rear spars to the bottom of the fuselage (like the Loening, for example). If struts are used, the reactions from a negative air load are carried by them in compression, and if the wings are braced by wires against the direct air loads only, then the spars, which must in this case be continuous over the fuselage, acting as cantilevers, carry in bending all negative loads.

A wing structure should have a factor of three to three and one-half under reversed load. If the design is well adapted to a wing with continuous spars, the wire type of bracing is satisfactory as it offers a minimum amount of air resistance.

In comparing a wire braced wing with an internally braced one, it should be noted that the former type, when acting as a cantilever, has only about 40 percent of the load to carry that comes on the latter from the direct air load. For this reason, one of the thin wing sections might be used on a wire braced wing if the increased efficiency of the thin wing section is of greater importance.

For internally braced monoplanes, the U.S.A. 27 wing section is quite suitable, combining as it does, large spar depth, high lift and high efficiency. It will not prove as satisfactory on a strut braced cellule, however, as it is impossible to take full advantage of the spar depth afforded.

On a braced wing, incidence wires in the plane of the struts should be omitted, for if they are effective in carrying drag loads, they put such heavy secondary stresses in the struts that the latter fail long before their normal safety factor is reached. All drag should be taken care of by the internal drag trussing.



Sketch of the spring scale described above for measuring the thrust of propellers on model aeroplanes

A-E-R-O-N-I-T-I-S

At eight o'clock we had a drink;
At nine o'clock the world was pink;
At ten o'clock the blow did fall—
The whiskey was wood alcohol.—*The Log.*

Jack—"How does a sailor come home from a home-brew party?"

Straw—"I dunno."

Jack—"Souse by yeast."—*Phœnix.*

In Church

There was a lady named Anna,
Who sang in a clear high soprano:
The tenor declared, as she fell down the stirs,
"I have heard, now I see your hosanna!"

Lines to a Movie Vampire

I sing today the Vampire of the Movies,
  I sing of Sheeza Beara—and she is—
Whose architecture Doric
  Is a clutter of caloric
  As she vamps it in her transculent biz:
I love to see her zaz a bit in Zaza,
  She writhes, she lures, she palpitates, she quivahs!
You ask me has she got the stuff? She haza!
  She agitates me very lights and livahs!

Them eyes of hern,
Oh how they burn,
Oh how they sparkle, snap and yearn!
Them liquid coives,
Oh how they swoives,
Its pretty doggone hard on noives . . .
She starts . . . she moves . . . she seems to feel
The thrill of life along her keel . . .
A rag, a bone and a hank of hair?
What do I care?
She's a bear! She's a bear! She's a bear,
  There!

I sing today the Vampire in the Movies,
  (Them eyes of hern!)
I tell you she's a regular Vesuvy.
  (Oh how they burn!)
Her agile architecture is conducive to conjecture,
  (Them sneaky coives!)
Oh lamp this lyric lecture 'fore her luscious lure has wrecked your
  Throbbing noives!
On yon Paphian piazza you just ought to see her zaza,
You just ought to see her, Yazza!
Has she got the stuff? Cazazza!
  But she haza! —*Froth*

Snuff!

—"Sneagle."
—"Snoteagle, snowl."
—"Sneither, snostrich."—*Burr.*

I gave her many kisses,
But still she cried for more,
And I couldn't give her any
For we'd passed the candy store.—*Juggler.*

Barber—"How do you like the new razor, sir?"

Victim—"I hardly knew I was being shaved."

Barber (flattered)—"Why, that's fine, sir; but what could you have imagined?"

Victim—"That I was being sandpapered."—*Virginia Reel.*

Rastus—"What fo' you all got yo' pants on wrong side out, niggah?"

Sambo—"'Cause Ah's goin' to de ball tonight and Ah wants to git de bag outer de knees."—*Orange Peel.*

Virginia had a little quart
  Of cider, hard as steel,
And everywhere she went 'twas sport
  To watch Virginia reel.
—*Gargoyle.*

Little beams of moonlight,
  Little hugs and kisses,
Make the little maiden
  Change her name to Mrs.
—*Medley.*

Recipe

First you take a cocktail shaker
  Then you add wood alcohol,
Neighbors call the undertaker,
  Pretty lilies. That is all.

American League Fan—"That woman's hose makes me think of a ball game."

Bushleaguer—"How come?"

A. L. F.—"One down and a runner on second for the Sox."

Fair Girl—"What was the row in class this morning?"

The Other—"I was slow in reciting, and the Prof. told me to shake a leg."

Fair One—"What of that?"

The Other—"Well, I shook a leg, and he excused me from recitation."

"Give Us Liberty or —"

May—"Why were you and George on the porch so long last night?"

Belle—"We were talking—on serious subjects."

May—"For instance?"

Belle—"O-o-o-o-h-h, The Freedom of the Press."

Iris—"Why does she want to marry that guy? His attic's empty.

Estelle—"True, but his cellar isn't."

Ain't Nature Wonderful?

One day as I chanced to pass
  A beaver was damming a river,
And a man who had run out of gas
  Was doing the same to his flivver.

First Listener at the Recital—"What do you think of his execution?"

Second ditto—"Long delayed—too long delayed."

Harry—"Newlywed died very suddenly."

Perry—"Yes, what ailed him?"

Harry—"His wife hit him with a biscuit when he complained about the food."

Perry—"That accounts for the inscription on his tombstone then."

Harry—"What's that?"

Perry—"Say it with Flours."

He—"I think that Jack is a good talker."

She, reminiscently—"Yes, he knows how to hold his audience."

She Couldn't Learn How

I knew a little co-ed, dears,
  Who's now a woman grown,
When I was introduced to her
  She stopped to roll her own.

In vain the sisters showed her how
  And did elastics loan,
But fifty times a day that child
  Must stop and roll her own.

When I pressed the fatal question
  She gave a little moan,
And before she answered, "Yes"—
  She bent and rolled her own.

And when she promised to obey,
  She said in lower tone,
Kind Sir, just pause a moment
  For—I want to roll my own!

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Navy Has Catapult to Launch Planes

Washington. — Secretary Denby announced October 16 that, after much experimentation, the navy has developed a catapult for launching aeroplanes from battleships which will soon be tested. A complete catapult unit is now ready for installation on a battleship, and if the invention meets expectations in tests in service, the machine can be produced in quantity and all battleships of the fleet can be rapidly supplied with this new form of aviation equipment.

The catapult consists of a carriage moving on tracks. On this carriage is mounted the aeroplane. The carriage is caused to move on the tracks at an increasing speed until, near the end of the tracks, its speed is sufficient to permit the aeroplane to take the air. Then the carriage is brought to rest by means of suitable brakes and shock absorbers. The apparatus can be made in varying sizes so as to be adapted to the launching of any aircraft likely to be used from surface ships.

Normally, when an aeroplane takes off from the flying field, it runs along until it has attained a speed through the air sufficient to sustain it aloft. This is known as its minimum flying speed. After attaining such a speed on the ground, it can be so controlled as to take the air and to remain up so long as this minimum flying speed is maintained. The length of run necessary is dependent upon the type of plane concerned and its loading, the wind, and the nature of the terrain.

In case of a very lightly loaded plane, such as a single-seat plane, with a strong wind against the direction run, the length of run required before leaving the ground would be very short. However, as a rule, the length of run required is considerable, and under unfavorable conditions it may be several hundred feet. To supply this starting speed from the ships the catapult has been developed.

When a plane is launched from the deck of a battleship by means of a catapult it cannot land on the deck of the vessel at the end of the flight. Thus planes which will be used from battleships must possess some means of flotation. At the end of a successful flight they will alight on the water in the lee of the ship and be hoisted on board by cranes.

In the case of planes operated from proper aeroplane carriers, they may be launched by means of catapults from the carriers, or, under favorable circumstances, may take off directly from the flying deck of the carriers, as from a field. Also, at the end of their flight they may alight on the landing decks of the carriers, where they will be brought to rest gradually by the arresting devices now being developed.

In the absence of the catapult in recent efforts to launch aeroplanes from battleships platforms were built on the top of turrets and supported by the muzzles of the guns. The turret was so trained as to point the plane directly into the wind.

Under favorable conditions it was found possible to launch small light-loaded aircraft. The apparatus was heavy and cumbersome and interfered with the turret on which it was used. The plane was not locked to the platform while it was attaining flying speed, and a side gust was liable at any time to cause a serious accident.

The catapult will be built into the ship which is to use it and will be so installed as not to interfere with any other part of the vessel. It is believed in navy circles that in the near future all surface ships will be equipped with catapults and aircraft as they are now equipped with small boats. By a system of tracks the aeroplanes will be run from their hangars onto the upper decks of the surface ships and the carriages of the catapults.

Normally, while the ships are cruising or in bad weather, the planes will be kept under cover in the upper decks, some disassembled and some partially assembled. Up to the present, due to the fact that aircraft are of such recent development in use on ships, the apparatus necessary for them has not been "built in." Naval officers say the battleships of the future will be designed undoubtedly to take their catapults, necessary hangar space, machine shops, the tracks and their aircraft, just as they are now designed to take their turrets and guns.

Seaplane Landing at Lake Champlain

The Commanding officer, United States Naval Air Station, Rockaway Beach, Long Island, reports that a landing for seaplanes can be found at Burlington, Vt., on Lake Champlain, in any depth of water from 0 to 40 fathoms, sand bottom, with excellent beaching facilities.

Obstructions consist of breakwater, small boats, and a few fish stakes placed wide apart.

Landmarks. — Breakwater and lighthouse.

Supplies.—Gasoline, oil, and fresh water, but no plane supplies; garages.

Burlington is a good place to go with either land or sea planes; altitude should be about 4,000 feet. Follow the Hudson to Glens Falls, then jump over to Lake George; do not follow the canal. There is good water all the way except small stretches of the Hudson above Albany and 15 or 20 miles of land between Glens Falls and Lake George.

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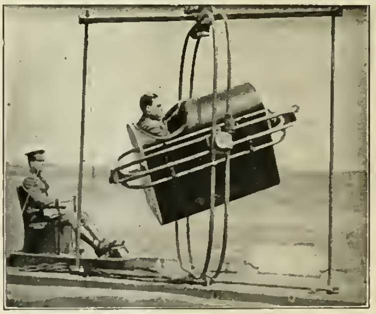

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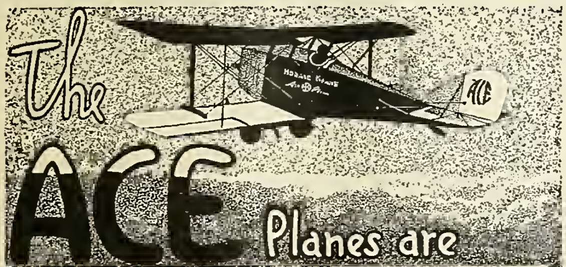

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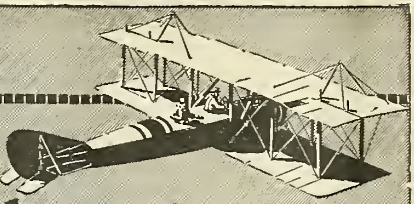

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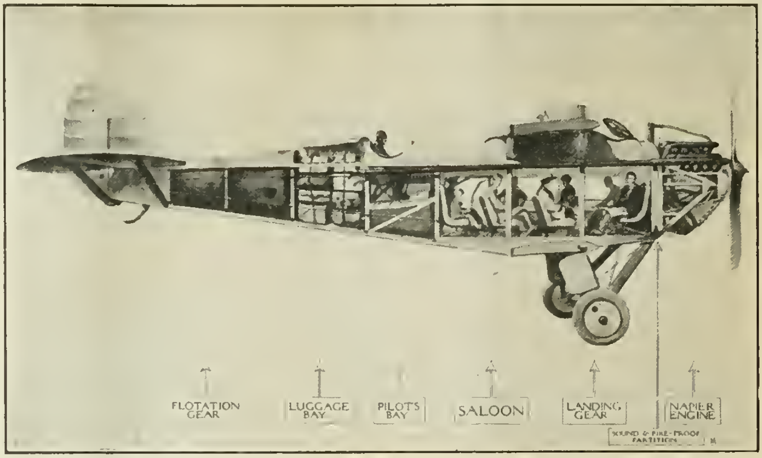

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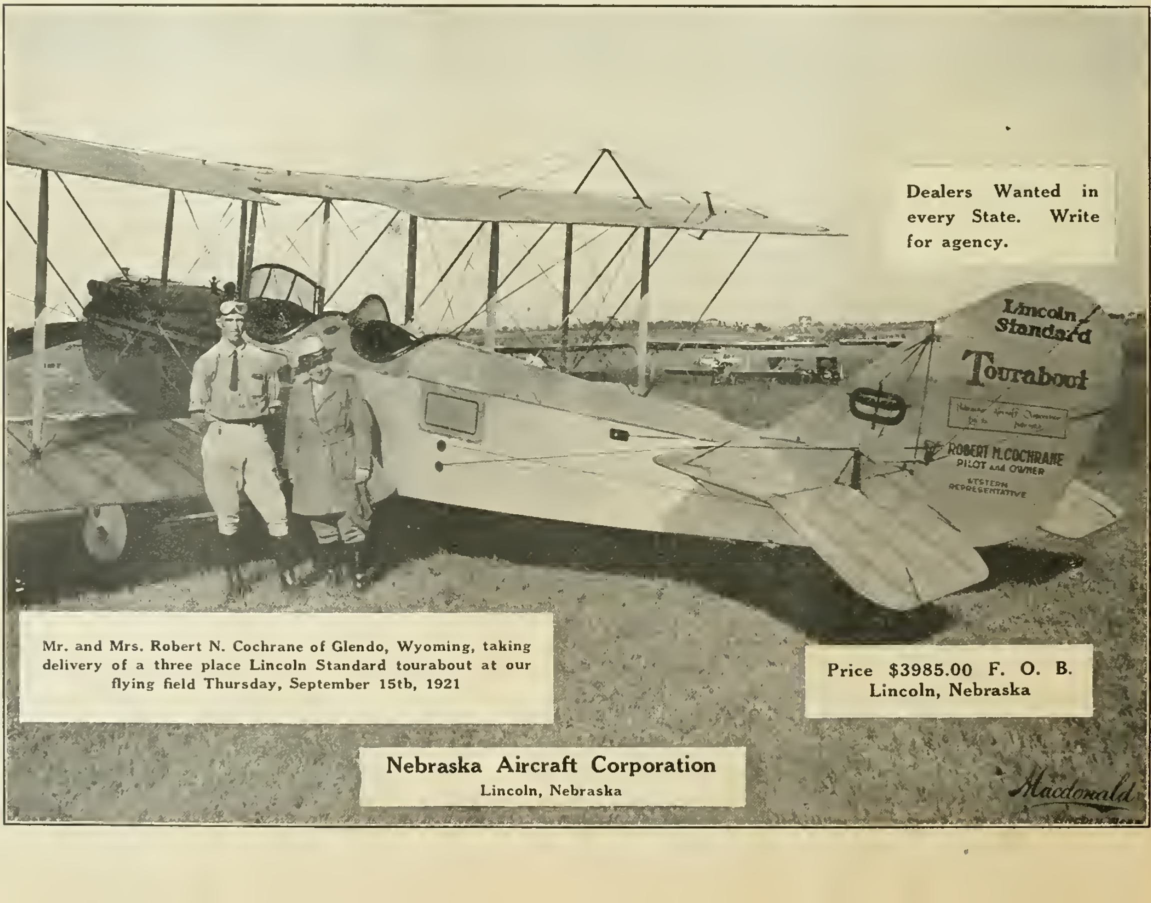

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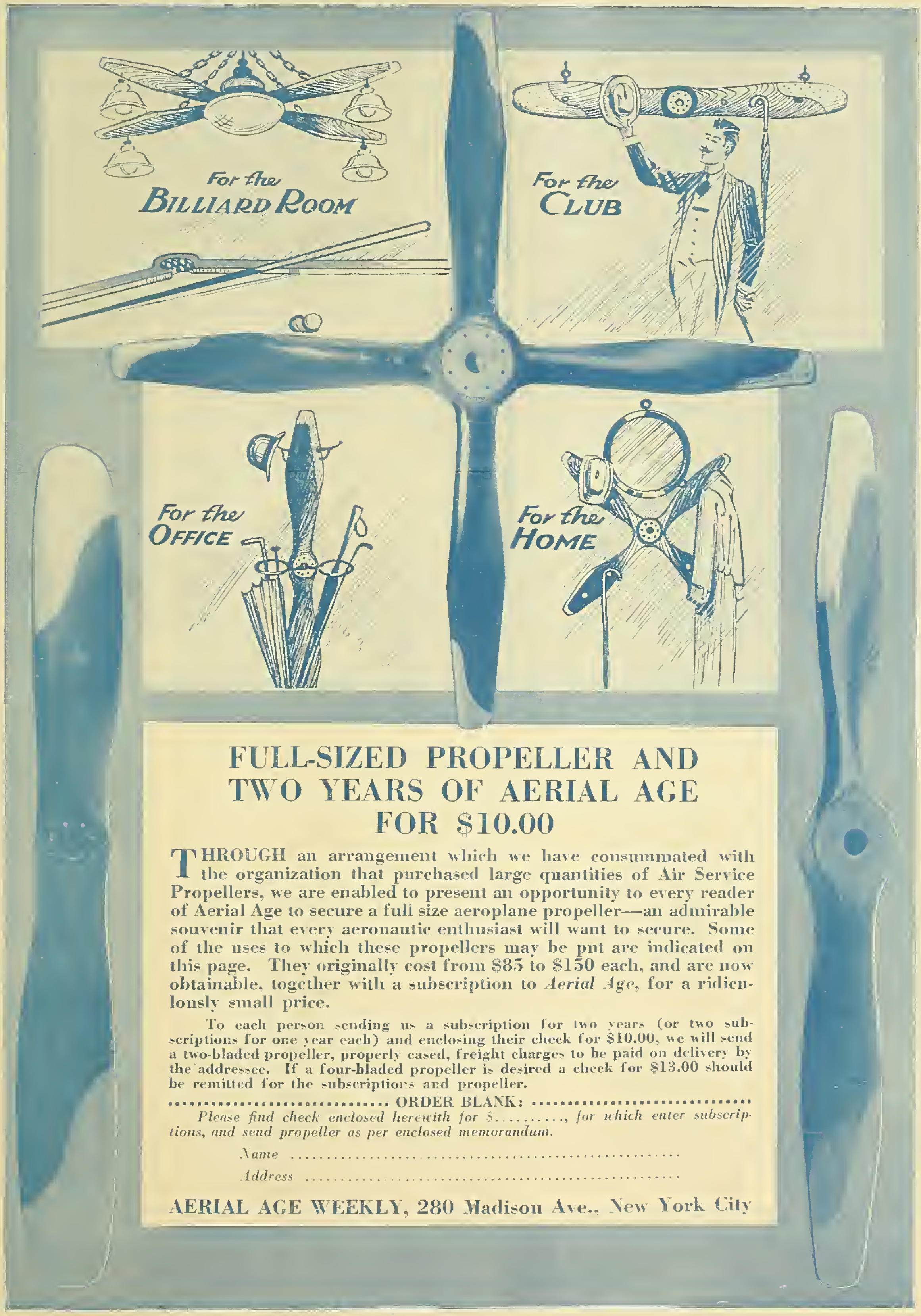

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